



Tech for Forests

How digital infrastructures can be an effective response to combating climate change?

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What has become of our rivers, our forests, our landscapes? We are so disturbed by the regional disarray we are experiencing, we are so out of sorts with the lack of political perspective that we are unable to stand up and breathe, to see what really matters to people, collectives and communities in their ecologies. To quote Boaventura de Sousa Santos, the ecology of knowledge should also integrate our everyday experience, inspire our choices about the place where we want to live, our experience as a community.

Ailton Krenak in *Ideas to postpone the end of the world*.

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The organizations and collectives: Greenpeace, Hivos and Coolab.

To the protectors of the forests, especially the indigenous peoples, who we have met in the course of this research.

¹ Some of the organizations were represented by people who are no longer part of them, but we would like to highlight them as fundamental for the results of our research.

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Introduction

We were in West Pará for a workshop on digital security with communities of the region when we confabulated the first ideas for this research. After visiting the river Tapajós - which was milky and green as a result of illegal gold prospecting - and strolling along the city's sweltering streets, we got back to the hotel and started to imagine what would a research about digital infrastructures in the Amazon region look like and what would its potential be in face of the climate crisis, one of the consequences of the region's slow but sure environmental degradation. We had been dealing for a few years with the gratifying (and at the same time challenging) task of talking with riverside and indigenous communities from many parts of Brazil about digital security. The experience of such encounters, felt on our own skin, brought up the inequality in the distribution of technology in the Amazon region, which led us to think about the need of access to infrastructures able to propitiate daily support to the communities we visited.

Physical infrastructures are rigid and are associated to big capital enterprises that, with their premise of eternal growth, insatiably devour the only house we have. Such structures are in the roads, in the hydroelectric power stations, in the dredge boats placed on the rivers (pouring in mercury and harming the bodies who bathe in the waters that also provide these with food), in the wi-fi internet connection provided in the illegal mining ports, in the mid-forest satellite antennas - which, without

maintenance, end up becoming a nearly performative image of what they could become. Digital infrastructures, in their turn, are malleable and enjoy the capacity of penetrating the existing physical infrastructures and corrupting the power logic in force there. Generally, digital infrastructures arrive in the communities by means of one Other: a visitor, a researcher, an NGO, a person who came over to talk about digital security; or else they arrive with someone who has left a community to visit other groups, bringing back the learning acquired. To master digital infrastructures requires comparatively less financial resources and starts off from a collaboration between users, developers and funders, being chiefly a matter of cooperation and of knowledge sharing.

In this context of environmental degradation, where illegality and threats are on one side, and resistance, commitment and union on the other, we sought to understand how the production and appropriation of digital infrastructure operating in this region takes place, investigating both the developers' and the users' sides. Thus, in the research here published in full, we analyze, by means of case studies and field work, the open-source digital structures used to the benefit of territories threatened by the illegal activities that contribute to the advance of the climate crisis, such as deforestation, invasion of legally protected areas and mining. Such infrastructure allows for, among other things, the carrying out mappings, creating patrol routes in remote territories, collecting and analyzing environmental data, recording and publishing denunciations, establishing means of communication in isolated areas.



In the period between the beginning of 2021 and the middle of 2022, we investigated open-source digital infrastructures used by communities that are under the constant threat of violation of civil and environmental rights. Such infrastructure is composed mostly by applications used as tools assisting environmental protection activities.

The research featured the parallel investigation on two levels: that of developers, the creators of the tools that allow for the collection and manipulation of data; and that of users, who, besides mobilizing such data in favor of their communities, often are also the agents who input the data in the systems in question, such as deforestation records, forest fires, illegal mining, invasion of protected areas.

In the developers' case, we can say that the all projects investigated here fall under the category formed by *individuals or by a group of individuals*, unlike projects constituted within an already existing company or formed as a fresh business. This kind of organization is characterized by being developed mostly by individual contributors, by a decentralized work method and by self-organization, devoid of strategies or explicitly defined and shared missions. We can further add that most of the projects we investigated were developed within non-profit organizations (not directly related to the development of

infrastructure, but to socioenvironmental causes), which at some stage employ digital technologies as a tool to improve the carrying out of their goals.

Another specificity that is worth noting regards the relation between developer and user. In most of the projects we analyzed, it is not a matter of a mere commercial relationship, reduced to delivering a product to suit the client's demands. Generally, the developers' participation is made possible by means of an invitation articulated via previous friendship and affinity bonds. In such cases, the developer's empathy towards social, political and environmental causes raised by the community for whom the infrastructure is intended is a necessary condition for his or her participation in the project. In this sense, the developer sees his or her own work as a contribution, albeit indirect, to the struggle committed to such causes. Besides, we can point out that the absence of such kind of committed relation can be one of the reasons why certain projects stagnate, such as when the organization hires – in a strictly professional bond – an enterprise to develop a tool that is useful in the solution of a problem has erupted at that point.

There is, therefore, a certain dose of informality in this process. This may be the case when a certain infrastructure is quickly put together in order to solve, as fast as possible, an emergency that crops up, but then issues related to documentation, publication, availability of the source code etc are relegated to the background. However, even if one cannot precisely tell whether a software whose source code is not publicly available is or is not open/free, it is

treated as such by the developer, who, besides being open to make it available to whoever asks, also deems the opening of code an ethical principle.

As with the other side of this relation, that of the users, we can highlight that there is a common concern with security, which is expected, since a good part of the infrastructure studied operates as tools for the denunciation of illegal activity, meaning that an improper management of the data used and produced by the infrastructures can compromise the community's safety. One notes, however, that coming to a sensation of safety does not take place through technical means, it is equally built within a trust relationship established between the community and those proposing the set up of the infrastructure in question. This relationship is built step by step, with workshops and participation in the communities' daily routines. Regarding the experience of usability, we have observed that, as Portuguese is not always the users' native language, data input by audiovisual means instead of textual means facilitates and speeds up the experience with applications. Besides, interfaces similar to that of social network applications - especially Whatsapp, generally the most popular application in the communities - are seen as friendlier.

Some of such aspects are developed in greater detail in the text **Free software, sustainability and social movements: interview with a developer**, in which Silvio Rhatto tells about his work in different fields towards the opening of codes and the strengthening of free software communities; a journey that includes the punk movement

and also civil society organizations, problematizing issues and seeking paths in view of the sustainability of projects that favor struggles for social and environmental justice.

Finally, the conclusions we have arrived at were brought together in three articles that detail and reach beyond the points above. Below, we present a brief summary of each one.

In the article **From anthropophagization of code to narrative hacking: how to weave incommunities?**, educator Luciana Ferreira and anthropologist Marcia Nóbrega offer a text based on encounters. Both work with different social movements and communities, especially indigenous peoples and *quilombolas* in the Brazilian Amazon region. These are people and collectives that in the last few years have been suffering attacks to their ways of life as they are spied on and monitored by extractive capital, by data and body hunters, who are predators of common goods and of the forest. The article's leading thread lies in the internet's infrastructures, its cables, antennas, its physical and opaque objective appearance. Grounded on that, they seek to cartograph the strategies of capture, the subjectivities that seem blurry to the naked eye, but that are nevertheless as impacting as a shark biting an optical fiber cable. The research shows that the technologies have to be at the service of the communities – and not the opposite. To bet on alliances between the indigenous peoples who have, from their territories, different experiences and learnings regarding the internet; but also alliances with the open source communities, so that the originary peoples are able to resist and draw

escape routes from the compulsory framing as mere users in the technological market as they are hampered from making their own “war machines”. The indigenous narrative hacking consists in devouring the codes, be them digital or cultural, and making of them whatever they like for their protection and entertainment. In order to enter such other domains without producing a bad body, a body for death, one needs, they taught us, to kin up - to increasingly produce more open and non-proprietary codes. In order for the sky not to fall over our heads, we argue that the opening to a common world is possible, even to those worlds established in open-recipes-codes, only if we start from a community in relation. In one word: from an incommunity.

In **Technology, communication and power**, Bruno Rigonato Mundim investigates digital infrastructures’ capacity for social transformation. Grounded on the network society theory by sociologist Manuel Castells, he argues that there is a relationship of interdependence between the three elements that compose the text’s title: the network communication technologies (constituting the digital infrastructures’ primordial space use) promote new ways of communication, which - because they produce meanings and influence the manner in which people think - reconfigure power relations, since the way we think and deliberate about our actions ratifies or contests the norms and values sedimented in the institutions that rule the society we live in. One notes that this transforming capacity takes place on two levels: when a digital infrastructure is employed to solve a specific problem; and when the very characteristics of network communication are manifested

in the organizational forms of society, so that the resulting actions and practices are based on non-hierarchical structures, on the horizontal coordination between autonomous groups, on open access, on direct participation, on decision making established by consensus, on the free and open circulation of information. So the text closely analyses three digital open/free source infrastructures cases, which compose part of the case studies analyzed in this research: SMART, a mapping and monitoring tool for environmental protection areas; HERMES, a digital data transmission system by means of short-wave, convenient for isolated regions, where the access to telephone networks and to internet is restricted; and Alertas+, a platform that brings together and organizes – in the form of infographics and statistics – data originating from different sources about environmental degradation.

In **Building communities, fighting against predatory infrastructures and developing open source softwares**, Narrira Lemos de Souza writes about the relationship between the communities of users and of open and/or free software developers. The author deploys the concept of *analogy* as fundamental in the creation of relations in the use of the tool; Narrira understands digital and geopolitical education as important to avoid the addictive use of certain digital infrastructures, understood as predatory; and points at the possibility of using other tools for the protection of these communities' territories. By means of a section of the history of open source she also shows that digital infrastructures, besides having undergone rapid transformations in the last few years, arrive in distinct ways to the forest protectors, with more risks and more online

exposure. In order to defy the predatory digital infrastructures, other infrastructures have to be embraced and built with the communities - and thus, a spectrum of needs is carried out: more active interaction of developers with the users, greater participation of funders in the projects, plus a firm commitment by the organizations to technology for the forest defenders and, above all, more funding for all the actors involved.

Free software, sustainability and social movements

Interview with a F/OSS developer

Silvio Rhatto has been a free software and open-source programmer for over two decades. Without specific formal training in the area, his trajectory started off as a self-taught learner. At the beginning of the years 2000, he began to participate in affinity groups and collectives that fomented the use of free software. His work, in his own words, kicked off side-by-side with social movements, in a do-it-yourself and alter-globalization perspective. Facing the precariousness of the tools in the internet at that stage, he sought to develop software according to the movements' demands. Silvio, however, recognizes his privileges: he has had the time to learn, to focus his efforts and, chiefly, he had access to a computer at a time when this piece of technology had not yet reached a very wide audience. In this interview, Silvio talks about development and technology movements, political contexts, emerging needs of organizations, sustainability of communities, the impact of the market and ideas for the future.

Do you see a difference between the open code movement of the beginning of the Noughties and today's?

First of all, I consider free software important chiefly because of the issue of collective freedoms and protections, such as, for instance, care with privacy and security.

My experience in Brazil has always been related to a perspective of movements, of doing collective stuff, but there are many other currents, including those that are very neoliberal or else that are found within a logic of the Brazilian State apparatus, deeming free software as a possibility for Brazil to “advance” and level up technologically.

Crucial to the difference between the movement of two decades past and today’s was the process of the emergence of a center-left social-democratic government in Brazil in the years 2000, who carried out a commandeering of the public apparatus by means of the employment of a militant base, including those who worked with free software and who would be responsible for the migration of systems and data formats into open alternatives. Consequently, this process ended up demobilizing the militants, who were converted into a bureaucracy, that is, there was a flight of the “militant labor force” into the government. This has driven, on the one hand, the adoption of free software and open formats in public management and the strengthening of the Free Software Forum; but, on the other, it has resulted in demobilization and the lack of renovation of cadres in the long run.

Many groups and movements who maintained this close relationship with the government, most of times one of dependence, ended up collapsing at the moment when the government suffered political defeats as the social-democratic coalition went down the drain. This is why **I notice there has been a kind of sudden disappearance of the movements, of free software as movement.** I do not mean the Free Software Association and the development cooperatives, who did carry on, but a general drive that has lost momentum.

I don't think that was caused solely by the political process in Brazil, since there was a role played by the market that stretches back to the times of the classic debate *open source versus free software*. The market has chomped off, worldwide, this open source idea and re-figured it as the concept of *open core*, under which there is an open core of software that is developed via a crowd-sourcing regime, relying on the contribution of a global community, but that in strategic areas still operates in the logic of closing the code and of protecting intellectual property.

An immediate example is Google, an enterprise who is the owner of proprietary algorithms that are simultaneously industrial secrets and fomenters of what began to be called a free software "ecosystem". Today there is an ecosystem management on a global scale, where a lot is developed on an open basis by force of a merely pragmatic reason and not on principle. For instance, this is a management that preaches solving common problems by means of the formation of communities of interest, grounded on the problems everyone has and by the search for solutions

based as much as possible on free software. However, producing open core became a pragmatics of “let’s see, there are people interested in working on this, thus we save on investments, we will enjoy free tests, community and non-remunerated support. We may eventually even outsource everything onto the community, paying a few key figures to keep the code’s base”. Consequently, whoever controls the development of big free softwares, let’s say, the free softwares that are of critical mission, such as Linux’s kernel and others, are the big companies, because they can pay more handsomely for development. That which was developed in community now is managed by the entrepreneurial logic while keeping a community facade.

We are beginning to notice the difference between open source and free software. As a product, they are the same thing and the licenses are compatible. Now, as a process, they are completely different things. As principles they are completely different things.

We are beginning to notice the difference between open source and free software. As a product, they are the same thing and the licenses are compatible. Now, as a process, they are completely different things. As principles they are completely different things. Thus it is possible that there is software that is developed in an authoritarian manner, but whose product is open; or a software whose community is

influenced by businesses who pay developers in key positions, directing where the efforts are going to be made towards. I again bring up Linux's kernel code as an example, whose recent versions will not run on very old computers, thus following the extremely techno-toxic logic of obsolescence.

I believe that in Brazil we were hit by this double commandeering: by the government and by big businesses, who appropriated the community and co-opted it. While a part of the community just needed a job, a portion was assimilated on the ideological level, thus producing a detachment of the free software community from the social movements.

In the countercurrent of these two trends, there was a debate regarding technology and social movements: whether the most important thing was to bring in people who were already from tech to work with the movements or if the most interesting initiative would be to train technologists among those who already were militants. And from a certain point the focus of some free software groups was to train (people) inside militant life. From this moment on I no longer paid so much attention to the free software community as a whole, perhaps already as a response to the decline of the Free Software Movement. This is where my present difficulty lies as I try to better understand what this movement has been transformed into and how much it remains as a movement, because I spent more time with people interested in solving political and social problems, independent of having or not previous knowledge for that. More important than accumulated

knowledge and experience is the attitude and stance regarding both. In other words, it is basically the do-it-yourself logic, which for me is a principle implicit in free software and a position regarding knowledge, learning and sharing. This is why I started to increasingly focus on inward-looking training, for groups and movements.

Today I realize that, if we think numerically and in terms of generations, we have a lot more people developing stuff in open source despite being them unaware of the history of what they are doing, not knowing where they come from as coders and not always adopting a critical stance regarding what they are doing.

Also, the writing of software today takes place on another scale, in an open source global market square. A lot was lost in the huge growth of the last few years. There has been a rupture. Such multitude of developments grew little in the wake of the free software collectives, groups and communities, but instead it was grounded on market logic and on the logic of digital inclusion via the labor market.

Today the panorama looks very different. The Free Software Association has lost impetus and the Free Software Forum nowadays finds it difficult to follow a series of important and fundamental agendas.

But we are also witnessing a transition with the emergence of collective groups and events linked to privacy, security, transparency and data analysis. In a certain way the Free Software Movement has been reconfigured in such groups, even if they are composed by other people or by other

generations. Let's take as an example the Cryptorave: it sources somewhat from the Free Software Forum but, despite sourcing a lot more from other experiences, it makes free software alive within the event and is able to keep its political sharpness. If they carried out a Free Software Forum today, a much more specific audience would turn up. Now, in an event like Cryptorave, where technology and its political implications are debated, a lot of different people are drawn in. Free software is more or less implicit in such groups and events around privacy, technology, transparency and data science. Such events also rely on the participation of various profiles: journalists, social scientists... and as its audience widens, the possibility of participation in events that have a code of conduct also opens up: they are more inclusive.

Cryptorave is an event that does not rely on public or business funding, not being muffled by the logics of commandeering, thus being more independent.

But such initiatives still seem to me to be very pulverized, rendering difficult a more general diagnostics. Perhaps there is still no convergent movement with enough potency to develop free software in an open, inclusive way and that solves common and difficult problems.

This reminds me of the place and time I have come from, in the wake of the alter-globalist movement of the Noughties and that featured this convergent aspect. It was not total convergence, but there was convergence, and the free software movement also seemed to be riding this wave of

confluence in the years 2000, coinciding with the arrival of the internet.

As the internet arrived, it united what was distant and drove apart what was close. It created this paradoxical effect between the local and the global, allowing for the convergence of very distant people, who started to work together. So I think that part of such convergence is related to this, in the context of the internet being used to deepen an extremely perverse globalization. The logic of the movements at the time was to use the very technologies of this new world order so as to halt the exploitation process and strengthen the cooperation operations. In order to do so, it was fundamental to reprogram the technology according to several ethics, including that of the free software. But not without the reaction of the new orders imposing their interests... Then comes September 11 2001, comes the war on terror, after that the world economic crisis, the ascent of a new extreme right, followed by the pandemic and by a series of other catastrophes that created shock processes, sweeping away such convergences or rendering them increasingly difficult to carry out. And then, this effect of the internet of driving people away from each other more than bringing them together is rendered even more explicit with the thickening of individual, individualist, individuating bubbles within the hyperneoliberal perspective.

The pulverization and multiplication of the bubbles hinders the sketching out of a panorama for free software, even more so as we try to answer the question with certain pertinence. But things are moving on, they are re-

transforming, the caravan rides on even if the dogs are jaded and we cannot cease looking at such processes without understanding the political contexts, and, finally, what was possible at each moment. So, I think that free software may have lost centrality, but I think it has not lost importance in any way.

What interests/motivates you in the open source projects?

For me source openness is a premise, as are security and privacy. It is a presupposition, it is a start, I start from this spot, I start from Free Software. To start from free software is my mode of action. I also come from another life path that is punk, and punk originates precisely from this, from the do-it-yourself attitude, from doing your own stuff, doing and remaking your own culture; but not in an endogamous way, where we bunch up just to do our little things and so on. But instead to receive, transform, copy, create and share, and do it whenever possible. Not only with software. Software is one of the many productions that we are able to make available to anyone and with no additional cost once the product is ready, once the production has been paid for.

There are particularities to each person's life, regarding what is necessary to do in order to live and to support oneself. I first have the need of a bread-earner, so I have to work, and I want to work in a place where it makes some sense to be in. As a programmer, there is no meaning in working in a place where the software is not open. So if I

had no other possibility, if the only thing I could do now, if the only job available was to develop proprietary software... well, then I would have no choice and that's the end of that. But having the choice I will opt for free software.

I think there is an intent behind the basic freedoms of free software, the freedom of running, studying, distributing and modifying it. We have very serious global and local problems, we have the issue of the inexorability of time, our life is ticking away... what will I do with my time? I can build a software that solves a specific problem, but I can spend a little more of my time making this software to solve a more general problem, and thus I will save collective time. Take this interview, carried out via the internet and with free software... how much time we don't need to spend to have this conversation now? We don't have to develop any of this, except if we want to learn how it is made...

Free software for me is a starting point, but it is not the only one. There is the principle of privacy and the technological principles that I am still discovering, but that are in line with William of Ockham, one of the thinkers in the long tradition against tyranny, who formulates: "let's not proliferate entities more than necessary". This would later be enunciated as Ockham's Razor... Following this principle, I will avoid complicating things more than I need to. It doesn't mean that I know which way is the simplest, but I will try not to complicate it too much. I think this is a principle that has a lot to do with free software. It is compatible with the refusal that states I do not want a life in

which I have a relation of servitude with technology, where I sometimes deal with this technique as a server, sometimes as a servant; neither do I want to keep a relationship of fetishism or of magic with it, which seeks to always transform this technique into a sellable solution for problems created by other sellable solutions, in an infinite escalation of technological dependency and unnecessary complexification.

Heading towards the general in order to see where I have placed free software, I have concerns in two keys: how do we evade the abyss of this torturing society we live in? If there is a technique, if there is an exit, this is a big problem. Today I try to tackle such issues. And the second point encompasses the investigations regarding what are the forms of good living that work out on several scales. So I think that I am between these two aspects and free software is there, implicit. If I carry out research, if I code software, I want to share it. Free software for me became part of an ethos, which is internalized more as daily practice than as a political cause that I take up in the role of a militant in one specific area.

You developed an open source software for an organization working with indigenous peoples. What are the main challenges you see today in the field of development of open source projects within organizations of environmental justice?

I think that the first challenge and perhaps the most important, is the very big abyss that exists internally and

between organizations. Normally there is a laboring class or a technical group that seeks the organization, or the organization seeks the technical group, in a relationship like water and oil. It is very difficult to live together like this, because you are not able to create something that really makes a difference. There is no debate around technique in both the indigenist and the socioenvironmental organizations. As I see it, there is none. And I stress this point. There are people who discuss, who study, but there is no debate, and I think this is impoverishing. Professionals who start to work in this area come in completely biased, with foibles, they are drenched with the market, so they arrive with bad market habits, market productivistic logics, market methodologies, and imbued with the market's single-mindedness, repeating "technique is like so", "technology is like so", "there is a correct way of doing it and it is this one here", "there can only be a single correct way of doing this". Other than that, organizations have a lot of demands to encompass... it's a lot of havoc to handle.

Another aggravating circumstance is that the labor market in the technological area has been extremely heated, and the non-governmental organizations find it difficult to offer attractive remunerations. The few people willing to collaborate can easily get frustrated with the absence of debate and follow on researching at university, or abroad, and even migrating to private enterprises.

In conjunctural terms, I think there is a series of strong landmarks that further render difficult the existence of this debate and the convergence of free software, indigenism and socioenvironmentalism as they force organizations to

increasingly operate in the key of urgency. As was the case with the new Forest Code. I remember a colleague saying that from that point on the avalanche of demands would begin in earnest. So we want to establish a landmark there, an inflection point, and I think we had this moment, like with the demarcation of the Terra Indígena Raposa Serra do Sol, which was another inflection point, because after that it was very unlikely that we would have another demarcation of such a large continuous area. And since then pressure has only increased.

Before these big turning points we could even say that the organizations were erring as they did not discuss technique, because up to then, no matter how busy life was, there were full conditions in place for this debate to figure in the agenda, but as I see it the organizations did not realize the importance of a debate around technique. Technology was just another consumption item, or an item in the budget spreadsheet, a funder's demand, or, anyway, a service that is simply bought. The water of the organizations dashed on the oil of the professionals who arrived previously biased. So, from my point of view, this was a poor encounter, not a joyous splash, but a mixture that did not mix. And this was harmful, because the time of relative calm was not well spent to create a common infrastructure that could respond not only to the usual demands but also to the increasingly more frequent urgencies and emergencies.

It is important to discuss technique not because we are technophile. Technique is at the base. Technology understood here as a way of doing something, of thinking

critically about this doing stuff, of considering if we could do it another way, what would these alternative ways be and what are the effects of what we do. So technique holds many dimensions, political dimensions, ethical dimensions, but chiefly an understanding that what the traditional peoples do is extremely technological, without underlining this mistaken conception that there are societies without history, without technique. What history is that? I think it is possible to discuss how we are to build our technological development, one not grounded on this word "development", one that is not grounded on this word "technique", but one carried out by means of encounters and mixing. I worked for ten years with a socioenvironmental organization and, as a developer, I have never spoken directly with traditional peoples in order to understand how I could improve my development, and how could I have a better impact on their lives. The conditions for this conversation to exist have never been created.

I have built a few pieces of software for this organization and I have always insisted on the data openness needed to run it, since access to the source code is sometimes a small section of the whole plot. So another challenge is this, opening data, which also depends on a series of processes and cares in order to secure their being available, updated, checked and maintained in the long run.

Another huge challenge is of facing obsolescence, both in the software developed in and by the organizations and their integration with those developed externally.

It is a mistake to think that the production of a software involves only an initial cost and that, after implementation, it will run on indefinitely. There is great difficulty in finding funding for the maintenance of existing software, for there is a stronger tendency towards funding novelty, the as yet non-existent software.

Unattended software tends to suffer what we call bit rot, the degradation of the software's bits.

Software is a number, representable by bits. So, in simple terms, to code is an activity that produces numbers. The work of the software developer is basically to create a number. This number only reaches the desired efficacy if it is run by a system that interprets the number in such a way as to produce expected results. If such systems change, for instance in the course of time with system updates, that number we initially produced may not be one that performs the expected outcomes. So, if the technology necessary to run the software effectively is changed, that is, if the technology becomes incompatible with that software, then the software in a sense has rotted away.

But it was not the software that has rotted. In a sense it was a rotting of the world that no longer bears providing efficacy to that number, that no longer provides the care; this technical and immaterial object is no longer compatible with the course of the world... a world where the rule is constant innovation producing "disruption" and obsolescence, processes that are intimately associated with the extraction of resources and the diminution of diversity in the territories. From the point of view of the rest of the

world, it was the software that has rotted, but in the perspective of the software, it was the world that has gone off.

I have been working on a concept to express this process. Where people call it the Anthropocene, *Capitalocene*, or even *Plantationocene*, I dubbed it the *Rottenocene*, this process of total obsolescence. We witness such processes of mass extinction and of desertification, which can also be understood as rotting processes.

Because of such challenges, I think that the socioenvironmental camp has serious difficulties in carrying out practical solutions in this technological field, with a few exceptions. There are exceptions. The very organization where I used to work boasted successful technological experiences, despite the big sustainability challenges, the dependence on constant funding as they were plugged into this big machine called “projects market”, with funding cycles usually a lot shorter than the temporalities necessary to create effective and durable software more able to resist the rotting operated by tendential obsolescence.

And specifically in the field of environmental justice, how is it possible to motivate developers to participate in such projects?

Look, I think that we have something that is automatically doing its own advertising, which is the environmental disaster already taking place, unfortunately. I think this is

something that motivates and moves people. We need to create and publicize more narratives that instigate and invite people to participate in this process. It is a process that can be very gratifying for people to collaborate in. For the creation of such narrative we need first to break the barriers between the organizations, between funders and the people more of the technical area, so to speak.

The choice of narratives is important, because we can invite communities to work together with more sustainable technologies. At the same time, this demands being careful, especially regarding the counternarratives that can undermine all the work done and can be formulated by those who profit from destruction.

Beyond narratives, it is important to think how communities can be fomented, without lapsing into the managerialism of the open source mentioned previously. And then to foment community is to think about projects, works or conceptions of projects that allow for the inclusion of people from different contexts, different conditions, different availabilities, different expertise and personal journeys, bringing this down to the concrete, avoiding the generic and the abstract. Concretely, how can we bring in these people in order to carry out such things? This demands thinking about systems and software architecture, about open hardware or social technology implementations and how all this stuff links up, as well as defining what are the common timetables. From all this it is possible to carry out planning compatible with more open temporalities, but that at the same time is effective in face of the urgencies of the world. In this sense I think we are talking about something new, which is not just reusing

what exists today in terms of project management and software communities. I think that if we just pick stuff off the shelf we will reproduce a lot of bad things and will favor precisely those other unwanted narratives.

I think there is a lot of work involved, I'd say that it is in the order of decades to carry this out. It is not a thing just for the next funding cycle and I think it is necessary to articulate scales of time-space, the short term, the local scale, but also the long-term stuff. A big challenge.

I think there is a lot of work involved, I'd say that it is in the order of decades to carry this out. It is not a thing just for the next funding cycle and I think it is necessary to articulate scales of time-space, short term, local scale, but also long-term stuff. Is it going to happen? Right now I am wading through not very optimistic weeks, so I don't really see it happening. But this changes with mood, and independently of it happening or not, time will be inexorable. We have a lot to do and to face such challenges seems to be a good use of our short time available.

What are the main causes of a project not going ahead?

This is a crazy question, isn't it, about what is to cease to exist. I understand that it is not the software that has disappeared, nor has it been glassed in at one of those software museums around us, but I understand that we are talking about the disappearance of the community that propels a project ahead.

Sometimes the organizations even manage to create an effective software project that can be used beyond the organization itself, but they fail as they are not able to create a critical mass of people to compose the minimum for a community. If there is such community, it is easier for people to feel encouraged to collaborate, for the frequency of debates and of software updates are basic signs of vitality. There is a whole art in maintaining such communities.

Evidently, it could be that the project refers to a problem of that specific moment and that ceases to be a problem further ahead, it ceases to be a focus of interest - then demobilization does set in. But this is not the case of many pieces of software in the socioenvironmental area dealing with priority issues...

To build free software is also to build communities. There is room and the need for more organizational roles, but equally there is room for communities where all participating people code and do management. It is important that there is care with management and with community strengthening.

In short, it is urgently needed to bring the socioenvironmental field in to discuss technology. There is still time!

From the anthropophagization of code to narrative hacking: how to weave communities?²

Luciana Ferreira da Silva
Márcia Maria Nóbrega

*Tupã has given us the boat, but not the oar.
He has given us the intelligence to create,
to cross the rapids
in order to arrive where we want*
(Indigenous community leader, region of the Upper Negro River)

From the Upper Negro River to the Pampas

There was a map. A map that covered the whole of the fourth wall of the Indigenous Organization's office. A local community leader, based on this picture, described to us his peoples' form of territorial domain. The scale vectorized distinct fluxes of rivers, affluents; it indicated communities with recent satellite internet signal capture towers that, during the COVID-19 pandemics, had arrived in the territory. We

² We borrowed the term "narrative hacking" from the "hackeo cultural" project, defined by their creators as: "To make the common sense out of the radical. Open source insurrectionist narratives. Defend life and the territory. Dismantle the systems of oppression one meme at a time. Live free culture and kitten GIFs". Available at <https://hackeocultural.org/> (accessed on September 16 2022). We thank Andreia Ixchú and Fede Zuvire for this meeting of narratives.

dived into it. One needs to learn to row, the leader whispered in our ears. He learned to speak our language. Not the Portuguese that is also his own. Masterfully, on the day after our first meeting, he introduced a workshop in Digital Care that we facilitated for his team. He talked about maps, georeferencing, monitoring, spoke also about the importance of security, of the network, of the internet. He made our language-code his own. He showed us, from his voadeira motorboat days later, his domain over the underground waterfalls that link up two much valued points in the map: a quasi-straight line between São Gabriel da Cachoeira and Santa Izabel do Rio Negro³.

Part of the around 200 young Guarani communicators, gathered under the canopy against the noon sun, spent their time producing smoke from their pipes of decorated wood. While they waited for the activity to start, they enjoyed the abundance of the available tobacco: we will smoke it to the end, one of them told us, we suppose, in his own language. But in the Guarani Indigenous Land where the Young Communicators' Meeting was taking place, to which we were invited to facilitate a workshop also about Digital Care, there was no internet signal. The school's and handcraft shop's faint wi-fi signal, unlike the tobacco, was not available to them. But these young communicators carried in their purses, in addition to their pipes, their cellphones where they recorded everything. Or perhaps more than that.

³ Our first visit to the region of the Upper Negro river, in the State of Amazonas, took place in the month of November 2021, when the COVID-19 virus showed signs of abating and all those involved in the expedition had been vaccinated. In March 2021, we established first contact with community leaders in the region, organized in a set of associations, with more than twenty indigenous peoples involved in the development of its economy, in climate and territorial monitoring, in the territorial governance carried out by the indigenous peoples themselves and in the strengthening of the community-based associations. We carried out interviews with four of these leaders, focusing on internet use and the circulation of information in the indigenous territories in the context of the pandemic.

São Gabriel da Cachoeira, considered the most intensely indigenous municipality in Brazil, is home to about 40 thousand inhabitants. Of every ten people, nine are indigenous. The region of the Upper Negro river, where the municipality is sited within the State of Amazonas, is known as the “dog’s head”: the territory’s outline on the map is similar to the animal’s skull. The indigenous narrative places that portion of the country in continuity with Guanabara Bay, calling it the “Milk Lake” (cf. Diakara, 2021; Lasmar, 2005); it was along this itinerary that humanity began. This is the triple frontier between Brazil, Colombia and Venezuela. Many languages are spoken, Nheengatu, Tukano, Baniwa, Yanomami, Portuguese, Spanish etc. Walking through the streets of São Gabriel is like strolling in a babel tower, only the confusion is lacking. Different languages are whispered, shouted, heard. All seem to understand each other. Their cosmopolitics sounds cosmopolitan: it is not unusual for a single person to speak two or three languages. They mutually recognize the codes, the words, the gestures, the food. Uncommon is the starting point of building themselves as communities⁴.

An indigenist friend takes us outside the canopy for a private word in order to welcome and to situate us regarding the meeting, which had started a day before. A general concern loomed: the exercise to be carried out on these internet-less days, in contrast with the free access to the network that some of the youngsters enjoyed in their territories, would

⁴ In this bundle of peoples, there is strong military presence. A border municipality, it is permeated by a logic of state surveillance and security. The Catholic Church is present with Salesian missions. They are huge buildings containing schools, where many indigenous children have been taught to forget their culture in order to consolidate the colonizing project. Hence the success and cunning of the indigenous people who learned the whiteman’s language and culture very well, but who also knew how to preserve their culture, which remains alive.

bring to the surface a series of controversies up to then not considered, at least not systematically, by such peoples. Spelling it out: what were we to do in face of the overexposure of these youngsters to the internet that had begun with the installation of antennae in the villages, as a policy of digital inclusion, a response to the imposition of quarantine by the COVID-19 pandemic? *There is no limit, he told us, they use the internet signal to the end.* There is no prohibition that could resist the technological sagacity of the indigenous youth: each password reinvented produces a hacker to break it.

In the streets of São Gabriel I saw many people with cellphones in their hands. Were they using the internet? Sending messages via Whatsapp, emails, navigating their Facebook or Instagram feed? Perhaps not. São Gabriel has no internet operator companies. It does not have an internet cable network. As in the forest, all internet used in the city is relayed by means of satellites. A technology that, regardless of being very expensive and complex, is still precarious. The low quality connection, however, was inversely proportional to the speed with which the young indigenous leaders learn to use the networks. *One has to learn how to row*, the leader's voice resounds. To know fresh possibilities, to widen this domain, is to strengthen the indigenous movement. It is, and not only just, a mobilization tool. How to make an alliance with the internet without being devoured? How to become related to the code in an opening to the movement?

A methodology

By means of this research effort we place along a line of encounters a few connections that start off from the

connection between worlds, carried out with the groups and not *for* them⁵. In order to do so, we articulate two geographically opposed world-spaces in indigenous Brazil. One lies to the north of the country, in the Amazon region where internet signal is still faint, but which is spreading and thus giving the peoples who live there the possibility for its future management or control when the signal finally does arrive. On the other end are the indigenous peoples who inhabit the southern and southeastern parts of the country, where the internet signal is strong, is everywhere and has increased in use in the villages during the pandemic. It arrived unannounced and set itself up in their bodies. We carried out workshops-meetings about Digital Care with both groups, when we explored different readings on the internet, infrastructure, applications, cosmologies and so many other lines that would give us the opportunity for distinct ways of thinking about what this recent relationship could offer.

By way of inspiration for the set up of the stories narrated here, we will be guided by what Donna Haraway (2016) dubbed *geostories* in her book *Staying with the trouble: Making kin in the Chthulucene*. That is, we started off from the statement that we need to tell each other stories with E/earth and her guardians as a possible escape from the "infernal alternatives"⁶ placed by capitalism: an exit from

⁵ As a resource to mark the different narratives that we built with the Guarani and the High Negro river peoples, we will use three distinct typographic fonts: one for the Guarani, another one for the High Negro river peoples and, finally, one for us. Speech in free direct discourse will be marked in italics, in their respective fonts.

⁶ In order to ground her proposition about the Capitalocene, Haraway was inspired by the book by Isabelle Stengers and Philippe Pignarre (2005), *La Sorcellerie capitaliste: Pratiques de désenvoûtement*.

the sorcery of capital that puts forward insurmountable choices towards an ineluctable end. In the case of the present article, we pursued stories of how to escape the prophecy that predicts: we are either consumers or producers; we are either users or developers.

Further, this article's methodology is fruit of a meeting between an anthropologist and a pedagogue intent on the exercise of learning and on the translation between different technologies, indigenous and non-indigenous, in the field of digital security, at the service of the defense of the forest and her guardians. In this translation exercise there is an effort of rendering symmetric concepts that are grounded on distinct cosmotechnologies. We are aware that this meeting does not take place without equivocation. That is, to use an image suggested by Eduardo Viveiros de Castro (2002), we know that every translation is also a betrayal:

My point of view cannot be that of the native person, but that of my relationship with the native point of view. Which involves an essential dimension of fiction, because it is about placing in internal resonance two completely heterogeneous points of view. (Viveiros de Castro, 2002, p. 123)

Our effort, therefore, does not seek the forge of a consensus, but instead an alliance between concepts. Thus, taking the equivocation, dissensuses and dissonances implicated in this meeting seriously, we are interested in thinking in what way the indigenous cosmologies appropriate the code, be it the digital code (machines' and their programmers') or the code of language (which allows

for communication within and between species), in face of the new world opening up.

The cloud and flying rivers

We usually start off activities with indigenous groups with the question: "How do you think the internet comes to us?" Then we offer paper and markers to each person or groups for them to draw and present their hypotheses.

Instigated by the question, young Guaraní communicators divided into groups and drew with pens on paper a series of compositions of lived worlds. They presented fused worlds, intersectioned on F's. In upper case, the F for *Facebook* and for the game *Free Fire* supported an image of a person with the head down, neck bent due to the overuse of cellular devices placed at chest level. The person was unable to see the following letter A or R, drawn in the form of a great tree. The proselytism of the imminent risk of a fall did not need to be drawn. Instigated to explain their compositions, a youngster remarked: *the truth is that everyone plays games and I, who did not learn how to stop, ceased to eat, to sleep and I ended up with a debt of thousands of reais*. Other stories followed, of many youngsters who, busy with games and social networks, ceased to seek the shamans who, in their turn, accused them of producing *bad bodies* for themselves.

On the other side, by the Upper Negro River, we were told:

I made an antenna, it is a little crooked because the satellite signal is very strong. The creators of the internet cast the signal to the satellite who then sends it over to us down here.

I made many paths because the signal spreads. It is just like the forest, it has many pathways.

I drew a satellite, which is casting the signal to the Wariro house [the indigenous handcraft shop], where people are trying to access e-mail, but they are unable to...

I drew it beautifully, I am selling this! When I started to use the internet I thought there was a rocket that launched the satellite upwards and it sent the network down to our computer, which was very big before... Now we have to climb on trees in order to see if the signal is coming to the cellphones!

In both cases, as we talked about the meanings presented about what the internet is and how it works, we realized that there is a vague and little explored idea regarding what might be the whiteman's technology that supports the internet. This way, we reach the collective conclusion that part of this technology is made for us to behave as mere users of it, passive consumers of a commodity that comes from outside, from the world-beyond of the white people. The question of how it arrives, where it comes from, imposes a stalemate regarding the composition of these worlds in recent relationship.

Let's consider clouds: we told them they do not exist - not the ones made out of internet signals, intangible nebulas where we place, just like magic, what we have produced as data (different from the smoke signals that roll out of their adorned pipes). Better said, in the world of the satellite internet, the existence of a physical cloud only proves that the other is part of a cosmopolitical imagination that is not theirs. In the friction between F's, the cloud is a physical

barrier that blocks the signal, which is physical itself, from reaching their devices in the villages in rainy days. It is as physical as the trees they have to climb on in order to capture the internet signal that comes from the sky, or those on which they trip as they get distracted while playing games in their cellphones. The internet is as physical as the transoceanic cables, antennas or computers⁷.

And all that made a lot of sense to the indigenous people, guardians of the forest. That is, the existence or not of a cloud while empirical materiality is unequivocal both to them and to us non-indigenous people. We know it is very probable that what they understand as a cloud exceeds that which we conceptually understand (i.e. a cloud is not just a cloud depending on the cosmological relationship that is established with it). Notwithstanding, it is also true that we all agree about what is a cloud when we point at it in the sky. In order to think about such differences, we followed the clues pointed at by Marisol de la Cadena (2018) in an article she wrote about the meetings and conceptual deviations among environmentalists and guardians in the struggle for nature safekeeping in Peru. For this, she distinguishes two distinct conceptual

⁷ In order to visualize the distribution of the underwater optical fiber see, for instance, https://pt.wikipedia.org/wiki/Cabo_submarino (accessed on 15.9.2022)

processes that share the same friction zone⁸: dissensus and equivocation.

I ground the idea on Jacques Rancière and Eduardo Viveiros de Castro to conceptualize it as a confrontation that contains a historical dissensus – Rancière’s term – about an equivocation – Viveiros de Castro’s term – about *what a territory means and the relations that compose it*. Together, these two concepts, dissensus and equivocation, may function in a way not possible to them in isolation (de la Cadena, 2018, p. 98, 99)

The equivocation, she says, from Viveiros de Castro, that

contains the “referential alterity between homonymous concepts” with which the entities that people Amerindian worlds communicate – or translate – between themselves. It is crucial for the concept of equivocation that, first, the fact that such entities – that we consider human or animal – consider themselves to be human and see their “others” as animals; and second, that *what they are results from their point of view, which, in its turn, results from their bodies*. [...] The motive for the differences between points of view resides in their different bodies; the

⁸ Here we allude to what author Anna Tsing (2004) dubbed *friction*: a concept deployed to explore environmental policies in defense of the Indonesian forests in the context of globalization, grounded on different agents in zones of attrition. On one side, mining companies, loggers and resource-grabbers; on the other, indigenous peoples and environmentalists. Friction is, therefore, a key concept to understand the cosmopolitan knowledge about nature, local and global, be it lay or scientific.

difference [therefore] is not conceptual.(de la Cadena, 2018, p. 99 – our italics)

One needs to highlight that, as stated, equivocation is part of a movement that has been called the “ontological turn”, especially after the writings by Eduardo Viveiros de Castro and Tânia Stolze Lima regarding Amerindian perspectivism, some of which have been collected in the book *As Metafísicas Canibais* (2009). As an illustration, the most famous example given for the understanding of what perspectivism may be is the relationship established between humans and jaguars. That is, from the Amerindian point of view, the fact that humans and jaguars share the same concept of “blood” or of “beer”, does not stop the jaguar looking at human blood and seeing it, from its world, as beer – and devouring us. Equivocity speaks, thus, of the possibility that distinct worlds and their beings share concepts that, notwithstanding, often refer to different compositions of its matter. To speak in the author’s terms, in place of a “multiculturalism” of points of view, the Amerindian world deploys a “multiculturalism” in order to deal with an incessant struggle between perspectives that is only resolved by the consolidation of a perspective that is “human”.

Dissensus, in its turn, even if it may resemble equivocation, differs from the latter because it is about something of the order of the concept, of the validation of the understanding about a certain thing.

Rancière, philosopher of politics and of aesthetics, conceptualizes dissensus as “the conflict between

someone who says white and the other who also says white, but who does not have the same understanding of it". [...] the misunderstanding that sparks dissensus (à la Rancière) results from "a dispute about what to speak means", "a dispute regarding the object of discussion and regarding *the capacity of those who make an object out of this*". Besides, as a *political interruption that changes the conventional order and establishes disagreement regarding equality*, it is a dispute that confronts those who have (to whom is conceded the capacity of) discourse and those who do not have (to whom is denied the capacity for) discourse – it is a dispute about the conventions that distribute capacities to define what and how it is. (de la Cadena, 2018, p. 99)

Both, therefore, refer to misunderstandings. While equivocation reports to a relation between equals (even if on ontological terms they are mutually other, for their bodies differ), dissensus emerges from the positions of subjects who, ontologically being the same, find themselves in sociological difference and, confronted with that, dispute in order to be in agency equivalence in the efficacious action in the in-relation worlds. In the terms that regard our discussion: in whose interest is that the internet is thought of as a nebula-cloud and not as a bundle of wires (and also of satellites and antennae) that overcodify the mercantile routes of world geopolitics? That is, we know that, as much as physics, the internet is both political and a right: the materiality of the equipment is operated by disputing people, interests and powers. This questioning was part of

our conversation in the meeting-workshop with the indigenous people⁹.

Or further, if we take clouds seriously, what does this discussion has to do with the correlation between distinct technologies, ours, non-indigenous digital, and theirs, guardians of the forest stretching from the north to the south of Brazil? What does the dissensus between clouds causes as droughts in the routes of the flying rivers, which carry in the skies waters from the Andean-Amazonian watersheds to the rivers of southern portion of the continent?¹⁰ Or, to use concepts closer to theirs, to what measure do these clouds coincide with those clouds that hover above the “dog’s head” and flow into the Guanabara Bay’s Milk Lake according to rionegrense mythology – and then follow on to feed the paran -rivers on whose margins the Guarani indigenous relatives dwell?

Open source and the incommunities

⁹ Brazil’s Federal Constitution secures to all people the fundamental right to freedom of information. Article 5, item XIV, states that “access to information and source confidentiality are secured when necessary to the exercise of the profession”. Item XXXIII of the same article states: “everyone has the right to receive from public institutions information about one’s own private interest, or of collective and general interest, which will be provided within the lawful period, under pain of responsibility, except when secrecy is absolutely necessary for the safety of society and of the State”. Brazil boasts one of the most modern internet regulatory legislations, Law no. 12.965/14, commonly known as the Internet Civil Landmark, which regulates the Right to Access to the Internet and establishes it as a general right and essential to the exercise of citizenship. It also defines the technical terms usual in the life of all of us, people connected to the network.

¹⁰ About flying rivers see, for instance, <https://riosvoadores.com.br/o-projeto/fenomeno-dos-rios-voadores/>. Accessed on September 8 2021

In our workshop by the Negro river we told a story¹¹.

Suppose I come here one day to the house of Ms. D and she offers me some tea, a very nice cuppa brewed from many ingredients that strengthen the immunological system. I tell her I gladly accept, but also that I have a restriction regarding cinnamon. If I drink or eat something with cinnamon. I may end up in hospital! So she tells me chirpily that in her tea's recipe there is no cinnamon. So I ask her for the recipe so I can confirm the information. Still chirpily, she smiles and tells me: 'I can't give you a list of ingredients, because the recipe is a family secret'. So what should I do? Trust Ms. D as I risk ending up in a hospital bed? What would you do?

The group was intrigued. We followed on saying that the open or closed source operational systems work in a similar manner; in open source, the developers open up the "recipe", the codes are visible for any person to know how they are made and what's in it. But the proprietary source systems do not open, and they may contain ingredients of mixtures that do us harm. Proprietary source works as if we just had to trust, by convention, its recipe-mechanism. Because, even if we can't read it (or that, ultimately we are unable to read it), there is someone who can - and so proprietary source delivers us the ready-made product as a commodity. All that is left to us, therefore, is to be consumers of cups of tea and of programs. In face of

¹¹ This is a story told since very long ago by members of the open source community around the world. A quick search in websites gives us hundreds of options, such as, for instance: <https://www.itproportal.com/features/open-source-kitchen-a-recipe-for-security-success/> [accessed on September 4 2022]. The practical approximation between the elaboration of an open source code and the baking and selling of a cake, for instance, allows for a learning image in people's daily life. In the light of the aims of this article, and that we are talking about indigenous group in their territories, founded on mercantile relations, we will resort to this particular use of this plot.

this and from a dialogue with Amerindian cosmologies, we suspect that, in the after all, perhaps it is not us consuming them, but it is they – in their unknown parts – who are devouring us.

“Should we or should we not trust?” This is, we think, a false dilemma. Or perhaps it is a problem that is not well put, because it is grounded on a morality alien to the other-than-not-indigenous cosmologies. From the start, the Amerindian formulation would emphasize the transitional content of the verb: trusting is only possible in a relationship implicated with other subjects. In Portuguese, the verb is transitive and indirect, there are prepositioned subjects in it. We have trust in something or in somebody – provided the subjects share one same perspective, human-to-itself, about the world. That is, what we argue is that in a world where things do not exist *per se*, isolated and individual, even the open-source-recipes are only worthy of trust (i.e. they are recognized in their efficacy) if they start from an in-relation community, in perspectivist resonance about the world.

In this sense, we invite the reader to a brief overflight of a few theories of indigenous thinking about the compositions of worlds, which takes place by means of the production of bodies, of their transformations and of what they eat. Let’s go back to the food analogy. The young Guarani’s addiction to the game Free Fire led her to stop eating and sleeping, and she stumbled on debt. She modified her body, which no longer sought cure with the Shamans. They, in turn, accused her (and all who behaved in the same way) of producing a *bad body* for herself.

In the article titled “Outras Alegrias...”, Guilherme Heurich (2015) studies the use of *cachaça* (Brazilian sugar cane spirits, a kind of coarser rum) in a Mbyá-Guarani community in the country’s south. The joy of *cachaça* differs from the one offered by the use of tobacco. While the latter brings them closer to relations with divinities, the former drives relatives away: “*cachaça* has no brothers, has no family. *Cachaça* has no relatives” (p. 534), his interlocutors told him. This is, then, in the formulation of the author, an anti-kinship vector. The state of addiction to *cachaça* causes the social isolation of a person, making him or her lonely, angry, bringing the individual closer to a conduct reputed to be of the dead. They who, in longing, seduce us to forget living life well in order for us to join them in death.

The Guarani eschatology says that as the body is a “bundle of affections” (Pierri, 2013, p. 216), its composition starts both from a physiological diet and from conducts that bring it closer of the divinities’ bodies. We should emulate the “light” diet of the gods who, avoiding foods that rot, and together with rituals, play, dance, finally composes the aimed at state of the divinities’ bodily imperishability. The bad body, on the contrary, is but a body-for-death, a body that can no longer belong to that human quality. It groups, so to speak, with bodies other-than-human, which include the dead body.

In an essay-article bringing together ethnographic findings of several indigenous peoples of the Amazon region, Carlos Fausto (2002) argues that it is possible to think eating less as the production of “an undetermined physical

body, and more like a device for the production of bodies related by kinship" (p.8). In other words, the act of eating with or like someone makes all the difference in the composition of such Amazonian Amerindian sociabilities that are in continuous transformation. The opposition between *one acting by predation (the domain of hunting and war)* and *one acting by commensality (the domain of domesticity and kinship)* becomes, in the author's argument, faces of a continuous process of familiarization.

Predation is, then, intimately linked to the cosmic desire of producing kinship. Every appropriation movement detonates another process of fabrication-familiarization, which consists in giving body to the exterior principle of existence and making it interior. This means to give it the characteristic dispositions of the captor's "species" and, thus, make him or her a relative. The sharing of meat and commensality not only marks relations between relatives, but also produce them. To eat *like* someone and *with* someone is a strong vector of identity, like abstaining for or with someone. The sharing food and of culinary codes make up, therefore, people of the same species. (Fausto, 2002, p. 15)

But what all this has to do with our conversation? What we have argued is that the sharing of recipes is carried out among commensals, those *with whom one eats*, who are, substantially, those who are not the prey (relatives or non-edible animals) or those with whom one does not start a war against (potential relatives, friends). In short, in the Amerindian universe, hunting is war in an interspecific variable. And, even in hunting and in war, mechanisms for

the production of kinship are agencied: it is necessary to transform, by means of the ingested food-code, the portion of enmity of the other as a force of familiarization. The anthropophagic rites emphasize this premise: in the case of the death of a human, if caused by a warrior of the same species, it is usual that part of his flesh is offered to those who did not participate in the predatory event. While the ingestion of the victim by the killer can poison him, bringing the killer too close to a world that is not his own, if the victim is consumed by others, these will absorb the qualities of the dead person and at the same time as they help him join his new world. Thus, given the dangers and risks that such transformations bear, these cannot be made without a series of restrictions and cares, practices often translated by ethnographers as "policies of *resguardo*" (cf. Belaunde, 2016)¹².

On the side of non-indigenous free software community programmers, it can be said that trust in a given open source software is less a matter that regards knowledge about it (i.e. whether we know how to read it or not), and more of a possibility to access it. In other words,, even if we do not know how to read a specific code, its openness allows that, if there is a harmful part, it can be, sooner or later, revealed and denounced, since its public scrutiny is available to *anyone*. On the side of the indigenous apprentices, what we have argued is that, for them, there is no "one" who is *anyone*; the subject's position is relative to

¹² These are mechanisms for the protection and safekeeping of the body, with severe food and sex restrictions. This is so that the body, in a vulnerable state regarding other worlds, does not cease to belong, by a regime of transformation and capture, to the world of its relatives.

the world in which he lives. This is why the openness to other codes is not carried out before making sure we keep ourselves safe from the risks inherent to capture by the perspectives of other worlds.

In other words, in order to become a relative of a specific even-if-open-code, one has to establish a kinship with it, with the recipes and its makers. In such conditions it is possible to have tea and programs together, *even if we don't know exactly how or what they are made of*. That is, we are talking less of about a dispute on epistemological terms, of the order of knowledge, and more about a dispute on ontological terms, of a position of the subject who is always relative to the world in which one lives. In simple terms, the ingestion of the recipe-code, the anthropophagization of others people's code in order to render it one's own, even if it is built on an open format, can only take place when there is a *community*.

But what community we are talking about?

In our workshop-meeting by the Rio Negro we emphasized that the open source, grounded on the allegory of the opening of the recipe and its modes of preparation, is something very important for the choice of system, of app and of platform, because it brings us security, protection.

Our group of women uses Signal a lot more than Whatsapp. Because it is safer, we were told. Is Signal open source too?

One of the participants asks us, the very Ms. D of the tea recipe story.

We noticed that to present a difference between the apps that feature open source or not is central for us to advance in the idea of a free and participatory internet. The internet is a network and its applications work in the same way, in network. A person tells another that is using one social network, or that a certain communication app is better, and then an extended tissue in common is increasingly constituted. Strong, well woven, a point to consolidate truths that only exist there. Would Ms. D be confabulating the creation, the reacommodation of a recipe to be shared among the women at that very moment? Or at least, it seems to us that she felt more at ease, protected, with this code-recipe in order to weave pathways with the group of women of which she is part.

When this possibility was launched, we noticed a change in the attitude of the participating people as we instigated in the group of indigenous peoples the need for carrying out an internet project that rendered viable the use of protective technologies by open source, closer to what the indigenous peoples aim for and need. The leader in charge of the group took heart:

We do want the internet, but we need to take care of it, get training for it in order to have it in the territories, because youth is abandoning the culture because of the games, because they want to post pictures of the girls.

We had to be swift, to act with cunning.

We need a cable here in São Gabriel for the internet to be quicker. I was told the cable was coming, but that only the military and the hospital would get it.

Indigenist movements, indigenous women's movements, indigenous youths movements in an alliance with us, non-indigenous activists, confabulating manners of articulating, under protection, in face of the advance of the predatory internet, whose ways underline the geopolitical trails of power - *only the military and the hospital will get it*. In this game of alliances, of conjunctions between groups *who have interests in common, but that are not the same interests*, is where the idea of the community that we are pursuing resides. An alliance between indigenous people, women, youngsters, activists; but also between pipes and smoke, clouds, flying rivers, cables, antennae, satellites. Not denying with this that there are differences between the parts in composition, precisely, with its dissensuses and equivocations.

Such alliances are complex, though. Occupying the same space (that cannot be mapped in terms of a single set of three-dimensional coordinates), heterogeneous forms (universal nature, environment, water that resist translation into H₂O, earth that is an object and is not, entities I call ecologized nature - or nature insubmissive to universality) converge in the network by means of agreements that do not exclude differences. (de la Cadena, 2018, p. 19)

That is, what the proprietary source programmers and their merchant network call the internet-cloud is not the same that we, indigenous and non-indigenous activists, understand: at this stage we all agreed that the recipe-

code should be open and that it should provide communication in favor of the protection of the forests and of the peoples. We also know that the very idea of a cloud-forest possibly differs among us, network of activists, depending on the relation that is established with it. However, this does not stop us from carrying out a translation process between terms, of exchanging recipes, because we will drink together the same tea of transcelestial waters, even though the tea and the way of drinking it may differ – as well as the quality of the clouds over our heads. This composition of alliance, of agreements between guardians and activists-environmentalists in distinct cosmologies, Marisol de la Cadena calls “incommunities”:

Notwithstanding, both cases contain the possibility of an agreement that, instead of converging to identical interests, would be supported by “*incommunities*”: *interests in common that are not the same interest*. This agreement speaks of the possibility of an alternative alliance, which, together with the coincidences, can include a divergence constitutive of the parts: they can converge without becoming the same. This agreement could include a discussion about the single world as an ontological condition that the participants of the alliance do not share homogeneously and that, consequently, can be a source of friction between them. (de la Cadena, 2018, p. 19 – our italics)

But, which recipe? How to produce incommunities also with programmers, henceforward developers, and their open sources?

Between-domains: how to blur the outlines between user and developer

Let's return to the map.

The leader who took us around the rivers and streets of the Negro river region is someone in transit, in constant physical and also subjective displacement. He pays attention to everything that is new. Swift as a *paca* in movement and thought, he nimbly digests the information and uses it in a cunning, strategic way. He knows the territory like the palm of his hand, he knows the perils in the rapids, the risks that the rivers impose, as well as the forest animals and their mysteries. He showed us, on the map, the more than 50 internet spots recently set up with the support of the Federal Government. This leader is aware that the government is interested in exploiting the region for its ore, for everything that has been and still is appropriated from the forest as resources, but he keeps the firm idea that it was the indigenous peoples who arrived here before everybody else. It is them who have the best tactics to survive and to secure the territory.

The recently installed internet program in the headquarters of a few indigenous associations, via satellite, was described to us as very poor. The internet basically connects Whatsapp for audio and text messages, sometimes loading photos and documents, but almost never videos. It is a limited resource, set up so that they

could communicate during the isolation period of the COVID-19 pandemic. But the leader is aware that it is more than this. The ease with which he navigates the Rio Negro rapids, where he has domain, is not the same with which he navigates the digital world. This is still an unknown universe, which does not inspire safety so that it can be used or inhabited by the whole of the indigenous population. *One needs to learn how to row.* And, in order to do so, it is necessary to establish a relation of *domain* with this world.

In another workshop about Digital Care, when we asked the indigenous organization group to think of a word that summarized the way in which they felt safe, protected, a leader from the west Amazonas sentenced: *I feel safe when I have domain.* But what exactly are the indigenous people saying when they speak of domain?

In the field of IT, the term domain refers to a set of computer addresses, a sum of the IP's (*Internet Protocol address*), which in turn works as a kind of postcode, or generic label, linking a device (computers or cellphones, but not only) to the worldwide computer network. Without the domain, we would have to memorize a very long sequence of numbers, rendering infeasible the navigation of the network for non-specialists. In synthesis, in the digital field, when we speak of a domain, we refer to the name of a website, the address we want to access. This is a conceptual shortcut, a trail in a knot of pathways between devices that will lead us to our final destination.

As we then argued, such concepts do communicate, even if what these leaders are telling us when they speak of domain is of another order, one not exactly of the referent in use in the digital field – or, so to speak, of another nature. Or at least they should. Both refer to dispositions between a subject and the localities he or she navigates, to a relationship with a certain space and to possible ways that lead us to a destination. This will be our argumentative bias in this section of the text. In order to do so, through dissensuses and equivocations placed by the term “domain”, we will problematize the relation between conventions of what has been called “user” (those who use certain programs, networks etc) and “developers” (those who elaborate, their creators).

We highlight three conceptions present in Portuguese language dictionaries about the term “User”. It is defined as something or someone 1. who makes use of something, who has the right to use, but not the property; 2. who serves or that which is proper for our use; 3. was said of a slave of whom one enjoyed only the use, but not the property. That is, the term “user” is intimately related to others as “use”, “property”, “service”. Notwithstanding, the same Portuguese language usually links such terms to the meaning of words like “owner” or “master” that, according to the translation by ethnologists, is in its turn related to the term “domain”. These three terms bear dense meanings in indigenous languages and cosmologies.

For the *Suyá*, *kande*; for the Yawalapiti, *wököti*; for the Kuikuro, *oto*; for the Tupi-Guarani, *jar*; for the Araweté, *ñã*; for the Sharanahua, *ifo*; for the Kanamari, *-warah*. With

differences between one people and the other, such terms designate what we translate as owner, master, chief, body, trunk, main river. Instead of an exhaustive list of terms and their translations, what we want to underline here are precisely their relational variations. This because, as we return to Carlos Fausto (2008) in an article about domain/mastery in the Amazon region, these are terms (here subsumed under the formula domain/mastery) that engender kinship technologies permeated by relations that, when not directly specialized, are transferred to other worlds that are always in risk of derivation.

According to a large part of the Amerindian mythology, each existing domain originated in a primordial mythic disposition, a ground zero for the cosmos, able to contain "all plurality of the different singularities virtually existent" (Fausto, 2008, p. 332). The relational kinship method for the domain, suggests the author, is one of "adoptive affiliation", which, in its turn, is built from what he called "familiarizing predation". One owns that which one has fabricated (affiliation), but also that which one took for oneself (hunted, conquered, adopted). The predator recovers from its prey capacities inherent to certain domains foreign to him - which can be very dangerous. However, if well ingested, the prey's parts counter-effectuate inside a familiar body, constitutive of a new (in)community. This was what we tried to demonstrate in paragraphs above when we wrote about code-recipes shared in openness and under protective policies.

Having said this, let's go back to the space, its masters and the map.

It is said about the Amazonian Amerindian universe that everything, in principle, has or can have an owner: "the forest, the animals, the rivers and lagoons, but also an animal species, another plant species or further that bamboo grove, that bend in the river, a certain tree, a particular mountain" (Fausto, 2008, p. 340). Such domains, one has to stress, are not configured as discrete sociospatial units, portions separated in territorial discontinuities that can be detached, sold, bought. Which means to say that "the owner of a river" is not the same as stating that "the river is the private property" of this owner. We are talking about distinct cosmologies. In the Amerindian case, the owner establishes a relationship of domain in relation to something or someone. Before "having", the owner is given "a capacity to 'contain' - to appropriate - people, things, properties and [thus] to constitute domains, niches, groups" (Sztutman *apud* Fausto, 2008, p.335). It is proper to the owner-master to answer for something, to be responsible for it before an in-relation collective, and, perhaps more importantly, modulate worlds in continuous transformation.

Hence to speak of property is not very appropriate, since what is proper to the owner is to be changed. The multiple and fractal character of the domain relations requires internally composite people, "different from themselves" [...]. The model of the agent is not, thus, of the proprietor who annexes things to an unchanging Self, but of the master who contains multiple singularities. (Fausto, 2008, p. 341)

Indigenous peoples belong to a world with which they relate, with which they are in action, in movement with. They are not merely users, spectators of the things of the world and they do not wish to have its private property.

This is an important debate, because the fact that indigenous peoples in Brazil oppose the idea of private property of the land and of the natural elements that form the Earth explains why they are the main agents in the actions against climate change. In their own terms they also act in defense of the freedom of coming and going, of a world without enclosures. In this sense, we connect the struggle of the indigenous movement to the internet freedom movement and defense of the free software community, as well as the practice of engaging proprietary source - which is opposed to open source. Here we bring in the idea of the *uncommons*: a space where things and people of distinct order and nature (who have interests in common but that are not the same interests) may share one same world, without the need for having control over it as property grounded on a compartmentalization within limits controlled by external forces, such as the State's.

The community has open sources precisely so that everyone may contribute to the system's improvement and, at the same time, have it closer to the people who make up this community. The open codes are like forest trails, the tracks that are opened so as to allow other people to get in, to hunt, to gather food in safety. The codes are like the forest knowledges, of complex reading. Every crossing is dangerous, especially if one is unaware of who our companions are. In a village there are people who know

the plants, who talk with them, who are able to extract different medicine for the cure of ills. The shamans also know well the herbs that can kill. Programmers are also like that: they can manipulate codes so that life, creation, take place. But they also know codes that can paralyze, manipulate, addict, monitor, survey the bodies, bring about the experience in a bad way. In free software, open source is a trail in the thick forest that cannot be expropriated. In order to cross it, we must protect ourselves with a good management of tools and companions. But which tools, companions and management are we being told about?

We asked the indigenous youngsters of the upper Negro river to draw, again. This time we divided the group in two halves, by gender. The bodies of a man and of a woman were traced on brown paper on the floor and the outlines were to be equipped with everything the participants considered necessary for a safe journey. Next to the outlined woman, indigenous women drew a helmet, a cellphone, a watch, a backpack, shoes, and also garlic, lipstick, eyelashes and wide open eyes. The drawn man, in his turn, got from other indigenous men, a cellphone, a straw hat, a machete, a lighter, a hammock and a purse, as well as bodily paint, cigarettes and wedding rings for those *who were married*.

They told us:

Here we take along a lot of stuff. In our pockets we always carry tobacco. In order to protect ourselves, we indigenous people, need this kind of protection. Here the money, tattooed, if the guy has nothing, if he is frisked, it's on his arm!

Here the package is complete: machete, rifle... I wanted more time in order to add flour, pepper, salt. The jungle is like that, unpredictable.

Let's carry on in conversation with Viveiros de Castro (2008). According to the author, in the indigenous universe there is an approximation between the concepts of meeting and of event. The latter takes place when one is alone in the jungle, devoid of good thoughts and feelings. Solitude, mourning, depression, anger, these are dangerous affections that can lead to bad encounters in the jungle. As an example of event-meetings, he quotes the Nambiquara people, their necklaces and spirits, as well as the correlation they make with our identity cards.

For the Nambiquara, the large amount of black bead necklaces they make holds a metaphysical link with the spirits: "these necklaces are like your ID cards. If we loose the necklaces, if a spirit steals the necklaces, we are nobody. If they are stolen from us, the spirits can do anything they want to us" (Viveiros de Castro, 2008, p. 236). The comparison between the whitemen's ID card and the Nambiquara necklaces bring us elements for the inclusion in a specific space. The necklace, more than a mode of identification, is a protective object. The identity card or a passport in a non-indigenous society is determinant for one's survival: without it there is a big likelihood of a bad encounter with the police, for instance.

Still on the elaboration of quasi-events, Viveiros de Castro warns us that

True deaths by spiritual accidents are rare. In the encounters with spirits in the jungle, nearly always nothing happens; but something always nearly happens. This is the 'point' of such encounters: the jaguar nearly caught me... I almost answered... I almost stayed forever in the underground world of the peccary... I nearly laid with that snake who resembled a woman... they nearly ate me. The supernatural is not the imaginary, it is that which almost happens in our world, or, [something that happens] to our world transforming it into a nearly-another world. (Viveiros de Castro, 2008, p. 238)

This concept may back us when we observe the relations and the meeting of the indigenous peoples with the internet and its in-opening paths, grounded on the statements above. If necklaces are a form of identification and of protection in facing the worlds in the forest, what if the ID card or passports are elementary for entering the world of the internet? Which necklace, which clothes, which armor the peoples of the High Negro river and the Guarani will wear so that the encounter with the internet is a good encounter and not an almost-death encounter?

Once in an encounter, this time a virtual one with the Guarani people, a community leader expressed such concern: *The Guarani made the world. The Juruá (non-indigenous peoples) arrived, and we taught them to live here and they stayed on living with us. Now they (the Juruá) created another world, which is the internet. The Guarani have to learn to live in it.*

The drawings that some Guarani brought in to the workshop with young communicators show a bad encounter with the internet. These were lonely encounters, depressive and unprotected, producing bad bodies. Notwithstanding, even there, we can identify the “almost” that anthropology tells us about through the Nambiquara. If it is true that there is addiction to games and to social networks, it is also true that they were there, in the community, telling this story. The drawings by the people of the upper Negro river reveal another line of the “almost”: not like a limit-story, an ineluctable end, but as an incomplete story. Like someone who is still in the forest trail, gathering protective objects, helmets, lipsticks, hats, hammocks, wedding rings, making necklaces in order to face the new world.

What they told us was that in order to leave the condition of mere user one has to know, to have domain over the internet technology. To know with whom we walk, how to enter and how to exit, how to unlock, to escape, know the codes, their manner of preparation, in order to change the destinations of the navigation, to manage walking the trails and even opening fresh tracks. This is the developer’s task. Now, if the condition of the user is averse to indigenous thought and the position of the developer demands a domain that our leaders do not yet have, it seems to us more profitable to blur such outlines and occupy the space in-between, where the potency of the encounter is established.

But how to establish such between-domain zones? How to make the domain that the indigenous worlds speak of

converse with this one put forward by the digital world? We saw that the community leaders in the region of the upper Negro river aim to enter other worlds, render real the virtual potency that crosses the extension of their domains, in their terms. They want to be heard, they want to participate in the internet's entry process and in the new communication and monitoring technologies in their territories. They want to be users and, why not, also developers; their transformational culture allows them to be more than one at once. As strategy, it is necessary to anthropophagize the code: devour, eat knowledge and digest it so that the struggle gains in strength. It is necessary to establish *incommunities*, encounters, with non-indigenous activist developers and programmers. *But not only.*

The indigenous narrative hacking: the Guarani Map and other Baobaxies affair

The idea of an end accompanies Guarani eschatology. The idea of something finite, that is enclosed in a self-contained and delimited unity, the "one", apart from every outward relation and that links it to the "more than one" is considered bad. Here its apocalyptic prophecy: "Things in their totality are one: and for us who do not wish this, they are bad", in the words of an old Guarani shaman (Clastres, 2015, p. 185). This "one" would be the state, writes Pierre Clastres, the absolute instance, a non-negotiable position by definition. It is against the prediction of a single world that indigenous societies organize. They seek the Land

without Evil, where the multiple presents itself as an arrow and bow in the confrontation against totalization. *We will smoke the tobacco to the end. Will we use the internet to the end?* But against who, what for and how?

Launched in 2016, the project Guarani Map¹³ aimed at systematizing the Guarani people's territorial information, including both those dwelling in Brazil and those present in Bolivia and Paraguay. The data was produced chiefly by a network of researchers at the Indigenist Work Center (Centro de Trabalho Indigenista - CTI) and the Federal University of Greater Dourados (Universidade Federal da Grande Dourados - UFGD/Raíz), featuring mappings carried out since the 1970's in the southern and southeastern regions of Brazil, but also by other researches originated in the Guarani Continental project (Projeto Guarani Continental) of 2008.

The idea was to relate information on the Guarani indigenous lands with information about the demarcations, archaeological sites and connect them to the collection of the Guarani library available at the CTI. A monitoring tactics, by counter-mapping, of their territory. Like the Rio Negro community leader showing us the map that covered the fourth wall of his office, the Guarani were able to scrutinize their domains from a digital cartography. At the same time as the map helps them visualize the status of the Indigenous Territories' demarcation processes, it also allows them to monitor, by contrast, the preservation of their forests. That is, even if their villages are localized in

¹³ See <https://guarani.map.as/#/> Accessed on September 8 2022.

much deforested areas of the Atlantic Rain Forest, in comparison with the surroundings, it is clear that the areas with the highest concentration of preserved forest are to be found precisely within their territory.

The Guarani Digital Map was created in a collaborative manner, allowing for its decentralized update, fed by indigenous people and by indigenists, who share information about villages, population and demarcation of the territories. The database includes georeferenced points in the villages and Guarani indigenous lands shapes. It features open source and was developed in partnership with the Hacklab¹⁴ collective. An incommunity between indigenous people-indigenists-programers was set up then. For the establishment of between-zones, workshops to learn the program's use were carried out.

Notwithstanding, even if the researchers network carry on feeding information, the digital development of the map remains paralyzed. There is no funding and one of the greatest challenges is to keep the data and code updated, for this work depends on the collaboration of programmers and developers. As Silvio Rhatto explained in the interview that is included in this research dossier, where he talks about the perishability of equipment and the updating incompatibility of their programs, somehow, the Guarani Map entered the "Rottenocene" era. It has ceased to form incommunities: developers and programmers interrupted the feeding of their map-machine.

¹⁴ See <https://github.com/hacklabr/mapaguarani> Accessed on November 6 2022.

Among the elements of the devouring circuit, perhaps it is necessary to invite also the funders to the code banquet. Even if on the familiarizing predation mode, it is necessary to make them kin, to share with them not only the codes, the ingredients of the recipe, but also the manner and the *time* necessary for preparation. That is, the sharing of the open code-recipe among indigenous people, indigenists and programmers has not been enough to keep the Guarani Map food chain in movement. In this cosmopolitical round dance, we need to bring on the funders to the dance, so that we can weave agreements about time cycles together, in their inexorability and duration. We know that as with any recipe, if we leave the cake too long in the oven it burns, if too briefly it flattens. Without these technologies shared in the time-space, without the places for learning and for continued exchanges, communities are not made – least of all those leaning on heterogeneous alliances between uncommon elements.

An experience of other possible alliances is the Rede Baobáxia, a community network to which *quilombos*, Afro-Brazilian religious centers, favelas e urban peripheries converge, together with developers and researchers of the Projeto Siwazi Rowaihuuze Auwe (a Xavante people information network: connectivity, data management and appropriation of the internet by indigenous peoples). The latter is another collaborative network bringing together the Wede'rã village, Rede Mocambos and the Museology, Archaeology and Anthropology Center Laboratory at UNESP (Laboratório do Centro de Museologia,

Arqueologia e Antropologia/ CEMAARQ da UNESP¹⁵. Rede Baobáxia¹⁶ was born from this alliance, a collective of researchers of a São Paulo university funded by a state-owned organization. Baobáxia is a constellation of baobabs, of shared memories of territories in the same galaxy, under baobabs, which offers a possible route for the creation of the methodology and technology to escape the almost-death encounters related by the Nambiquara.

It kicked off in the Federal Government Culture Points program (*Pontos de Cultura*), that Rede Mocambos carried out using audiovisual material, with content produced by the communities and shared during the training sessions, by means of pendrives. In such occasions, the communities realized the need to create a technology that involved drumming, collections and communication, bringing in as a symbol the ancestrality of the baobab. The aim was to keep the memories in the territories themselves and facilitate the exchange between the villages, by means of technology at the service of their freedom and protection. A free software technology, made out in layers. Instead of a P2P technology, Git is used: a files structure informed by a logic of copying into wherever one wants – the metadata is shared and then the copies can be managed. From the partnership with Siwazi, the Baobáxia technology continues to be in movement and weaving a community.

An almost-end: temporary conclusions

¹⁵ See <https://siwazi.fct.unesp.br/> Accessed on September 8 2022.

¹⁶ See <https://mocambos.net/tambor/pt/baobaxia> Accessed on September 9 2022

At the end of the workshop, we went to the lake next to the Guarani Indigenous Land to refresh our bodies. An artificial lake, made by the flooding of part of the territory with the waters from the Itaipu Hydroelectric Plant dam. Guarani youngsters and children swam with ease in the midst of a series of submerged trunks, sections of the trees that once composed the local *pampas* landscape. Diving from the top of what had been trees before, they jumped in pirouettes into the violently pacified waters.

Earlier, while we borrowed the wi-fi signal from a local school, a non-indigenous teacher told us about the local handcraft, interested as he was in what he called the “tree of life”. Looking at the animals perched on the branches of the mythological tree, he told us that this was so because *the animals found shelter from imminent death by drowning sitting on the trees, thus producing the possibility of life*. Curiously, the drawings by indigenous individuals in workshops and, as we saw not only by the Guarani who accompanied us, indicate that it is from treetops that they access the faint internet signal reaching their villages. The tree is an antenna, a portal to the new world that opens up. Because for each world that ends, another one is born.

Animals, indigenous children and youngsters have retaken the domain over and under the waters. They have mapped the trees and their submerged trunks, which they have converted into springboards. Lagging behind, non-indigenous indigenists and digital security activists followed a little clumsily the traces of the route-trails opened by the skillful swimmers, to the smile of the onlooking children. An alliance between the uncommons

within the same “political ecology”, a concept that Isabelle Stengers (2018) formulated in order to deal with a paradigm she denominates “eto-ecological”, a union between the *oikos* (space/environment) and the *ethos* (behavior) of the beings who inhabit it, whose movements, between one and the other, produce effects that are always indeterminate.

The Guarani experience diverges in time and space from that of the indigenous peoples of the upper Negro river. There is no way one can tell if they will reach the end, because the end, as the Guarani say, never ends. *There is no limit*, our indigenist friend alerted us, *they use the internet signal to the end – and for each reinvented password, there is hacker to crack it*. Here the indigenous narrative hacking: the retaking in their domain of the digitized domain – they are always producing the oars that Tupã has given them the intelligence to create. But how to enter other domains without producing a bad body for oneself, a body for death – *how do we learn to row?*, insists the upper Negro river community leader. The answer, they teach us, is to relate as kin – and for that one needs not only to know which part of the other should or should not be devoured, but also who and with whom to devour. Security, before anything else, is *resguardo*, safekeeping.

The political ecology that Stengers speaks of places the meaning of the term *political* side-by-side with the *cosmopolitical*. Every translation effort between worlds and domains that this article brings up originates in this effort, among dissensuses and equivocations. Open and non-proprietary sources, recipes, teas, clouds and flying rivers

are grounded on agencies that, being so diverse, cannot be negotiated presuming the idea of a parliament where everyone would be equal, neuter and blind to difference. Finally, in order to avoid the sky and its smoke clouds falling over our heads, what we argue is that the opening to a common world is only possible, even if in open-recipes-codes, if they start off from an in-relation community. In a word: from an *incommunity*.

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Technology, communication and power

Bruno Rigonato Mundim

We are going to investigate three digital open/free source infrastructures that compose part of the case studies analyzed in this research: SMART, HERMES and Alertas+. The first is a tool for mapping and monitoring environmental preservation areas; the second consists in a digital data transmission system by means of short waves, convenient for isolated areas, where the access to telephone and internet networks are restricted, last is a platform that brings together and organizes - in the form of infographics and statistics - data about environmental degradation originating from different sources.

A common point in all three infrastructures is communication in network, whose structure¹⁷ favors:

1. Horizontal bonds and connections between autonomous and diverse elements;
2. Free and open circulation of information;
3. Collaboration by means of non-centralized coordinations and based on democratic decisions;

¹⁷ Cf. (JURIS, 2004, 342).

4. Self-management of the information that travels in the network

Based on this common point, we carry out an investigation about the relation between technology, communication and power, based chiefly on Manuel Castells' communication theory. From then on, we will try to justify the hypothesis that it is by means of the relation between these three elements that the analyzed infrastructures work against the noxious advance of climate changes. This performance is operated through the capacity of communication to influence power relations, since it produces meanings, directing our mode of thinking, which, ultimately, ratifies the norms and values rendered concrete in the institutions that constitute society.

Let's start with the definition of power given by Castells (2019, 83): a relation asymmetrically established that allows for a social actor¹⁸ to influence, in favor of his or her interests, wills and values, the decisions of another social actor. That is, in a power relation, there is always a social actor with a greater degree of influence, so that the instances composing this relation – the one who dominates and the one who is dominated – do not exert reciprocal influences.

In this sense, in a society constituted by power relations, whoever holds it shapes the social institutions according to their interests and values. Conversely, where there is power there is the possibility of counter-power, which is the

¹⁸ Social actors are subjects of the action, who can be individuals, collectives, organizations, institutions or networks (CASTELLS, 2009, 10).

capacity of the social actors to resist domination and eventually transform the institutions by means of which it is exercised. This takes place when resistance and rejection overlap conformity and acceptance, the latter elements inherent to those who find themselves in the position of the dominated in the logic of a power relation. In the extreme, when power is exerted by means of force or violence alone, so that the capacity for resistance is eliminated, it ceases to be a social relation. In this case, the power relations become *non-social relations*, because a social relation ceases to exist as soon as one of the terms that sustains it is eliminated (CASTELLS, 2009, 11).

Coercion, which is given by means of violence or the threat of violence, is a fundamental form of the exercise of power, of influencing the actions of a social actor in favor of the interests of those who occupy the dominant position. However, as noted by the author, few institutional systems manage to last long if they exert their power only through violence: "Torturing the bodies is less effective than shaping the minds" (CASTELLS, 2009, 83). In this way, information and communication play a relevant role in the clash between power and counter-power, because, instead of coercing, they persuade. Persuasion shapes people's minds, and, ultimately, is the way of thinking of people that drives the institutions' fate, which reflect the norms and values on which a society is built.

This can be seen in the manner state power is legitimated in a democratic system. The basis of the exercise of legitimate power is built on the sharing of a meaning in common, such as the belief in a representative democracy.

The State's intervention in the public sphere ceases to be legitimate the moment in which it is driven by private interests, becoming more a domination tool than one of representation. It is through communication networks, place where the citizens' interests and values gain expression, that are built the conditions for the civil society to discuss and deliberate in the public domain the content that grounds the State's actions, securing a legitimate exercise of power to democracy. As Castell states: "The democratic exercise of power is ultimately dependent on the institutional capacity to transfer meaning generated by communicative action" (CASTELLS, 2009, 13).

Communication, thus, plays a conditioning role in the establishment of power relations, because it is through the transfer of information that meanings are produced and shared. This affects the way in which people think and, consequently, conditions the meanings of the actions that people deliberate to themselves and to the community of which they are part.

Having said that, and taking into account communication technology in the digital era, which extends to several domains of social life by means of a network at once global and local, generic and personalized, it follows that the construction of power relations increasingly takes place in the field of communication. This construction, which articulates into a single place technology, communication and power, puts forward for debate a plurality of social actors, thus promoting a clash between several interests and values of the groups involved (CASTELLS, 2019, 84). It

is up to us to try to understand the specific characteristics of the conflict that operates from this technological context.

Castells (2019, 84) takes two hypotheses as a starting point for the development of his theory regarding the relation between media and society: a) mass media transformed the way of doing politics, because besides transforming the political processes themselves, it has contributed to a large measure to what we today recognize as the *global crisis of political legitimacy*; b) the technological and transformational changes in communications, chiefly regarding the advent of *mass self-communication* – a concept employed by Castells to describe a socialized communication established by digital networks of horizontal character¹⁹, have decisively changed the operation modes of media politics. These two points distinctively characterize the form of the political clashes in network societies, so that:

The uses of both vertical mass communication and mass self-communication in the relationship between power and counter-power, both in formal politics, and in the new manifestations of social movements and insurgent politics, have transformed the landscape of power struggles in our time.
(CASTELLS, 2019, 84)

Regarding point “a”, Castells kicks off from the thesis presented above that power depends on the capacity to influence the way people think, which is given by means of the long-reach socialized media. This role would be played

¹⁹ We detail this concept below.

primarily by television, which manages to establish a mass communication channel between the citizens and the political system. Despite the fact that this means of communication is not exempt from the influence of corporate and ideological forces shaping the message in favor of the power relations that interest them, this does not seem to be its greatest problem. For Castells (2019, 85), the absence of a message in the media is more significant than an explicit message aimed at shaping the minds in a given direction, since “[w]hat does not exist in the media does not exist in the public mind, even if it could have a fragmented presence in individual minds”. Without a presence in the communication media, that is, without visibility, the social actors find themselves by principle unable to intervene in power relations.

The words by educator and environmental activist Sandra Regina Gonçalves, spoken at *The climate story lab Amazônia*, in November 2021, were vehement as she brought attention to the exclusion of certain identities from the media – indigenous peoples, *quilombolas*, the sea people, the river people – from media space: “Enough of living inside big invisibility. For the government we are invisible, we do not exist²⁰”. According to her, this exclusion process involves institutions ranging from the big media to the curricular grid of the education system. Without

²⁰ It is interesting that the very presentation of *The climate story lab Amazônia* featured the demand for autonomous and plural participation in the field of communication: “We are facing a climate emergency. We believe that impact climate communication is more important than ever. Our challenge is to reach beyond the unified climate narratives of the past, identifying and widening a biodiversity of stories and narratives as diverse as the ecosystem we seek to heal” (<https://amazonia.climatestorylabs.org/>. Accessed on May 26 2022).

visibility, the erased identities do not participate or feel represented in the decision processes on issues that affect them.

In Castells' (2019, 85) view, every political message is "necessarily a media message", because, despite the medias not being the holders of power directly, it is within them that power relations are established and re-articulated. In the field of political marketing, this means to convert voters' attention into votes for a certain candidate. As voters generally do not read the parties' or candidates' political programs, attention is concentrated on the headlines of news broadcast in the mass communication media, which can propitiate a voting decision based, above all, on the trust the voter places on a specific candidate. As a consequence, one of the main strategies of political marketing consists in linking certain values to certain candidates, giving politics a personalist character, where the most effective message is the one that builds leaders from the projection of characters that flesh out an image of credibility and of trust (CASTELLS, 2019, 86).

In face of this media-informed and personalist scenario, politics is induced to one further characteristic: it unfolds by means of scandal. In this logic, values such as credibility, trust and character are the central elements in the decisions of a political dispute, therefore, the destruction of such values is one of the most promising resources for the political adversary who intends to impose his or her own reputation. This basically results in two consequences. The first can be observed in the short term: when a scandal involving a certain candidate puts his or her credibility in

question, the voters rethink their decisions, and this is reflected on the ballots. The second consequence is the constitution, in the long run, of a generalized discredit regarding the formal political system: everything that involves electoral promises, political leaders and parties is seen with skepticism (CASTELLS, 2019, 87).

We should have in mind, though, that our generalized disbelief does not imply in depoliticization. As Castells observes (based on empirical researches - CASTELLS, 2019, 88), several citizens still believe that they can influence the world by means of mobilizations, but mobilizations that take place outside the scope of formal politics. This leads us to the second hypothesis, raised a few paragraphs above in order to understand the relation between media and society. As already stated, power relations are reconfigured in the media space, because this is the premise in any democratic intervention in the public space. And given that traditional media is submissive to governments and corporations, who only reinforce the model of the formal political systems, an insurgent politics sorely needs a new media space.

Castells attributes this new space to *mass self-communication*, fit for political insurgency, which we can understand through the following main characteristics²¹:

- ◆ Many-to-many: while the communicational foundation of industrial society was characterized by an unidirectional mass media, in which the message is

²¹ Cf. (CASTELLS, 2019, 88-90) and (CASTELLS, 2009, 55).

distributed massively from one to many, in the network society what is in place is a horizontal global communication webs, constituted by an interactive exchange of messages from many to many, able to connect the global and the local synchronically or assynchronically;

- ◆ Self-generated content: in principle, any person with access to the internet enjoys the autonomy to generate content and publish it for free, a condition that has been driven by increasingly cheaper electronic devices, such as notebooks and smartphones, and by the availability of a myriad of open-source softwares, ranging from operational systems to text, image or video editors. What a few decades ago demanded the collective travails of professionals from different areas, such as recording, editing and distributing audiovisual or textual content, today can be carried out with a smartphone;
- ◆ Self-directed emission: the one transmitting a message selects the channel - with a specific potential audience - by means of which the message will be distributed, such as email, message exchange applications (Whatsapp, Signal, Skype), discussion lists, online forums, blogs, social networks etc. It is worth noticing that, once broadcast, it is practically impossible to control the reach of a message. A message sent to a single and specific addressee, for instance, can be redirected to other channels - be it due to a technical glitch, to a criminal act, or to an attitude by the addressee him or herself - and

potentially gain global reach, as demonstrated by the leaks in which private messages are exposed to a wide audience;

- ◆ Self-selected reception: in a certain way, the message does not go out to the receiver, as when we switch on the television or the radio, but the receptor, by means of the channels at his or her disposal in the internet and in the communication electronic webs, seeks the message of interest to him or her. In this sense, the receptor plays an active role on the reception of the message.

These are the general outlines of a media space that we can consider as the communicational foundation of networked society. Its pillar is the computer network, its language is digital, and its participants interact globally. And even if Castells does not support the thesis that the *medium* – i.e. the very communication vehicles – determines the content and the consequences of its messages, he seems optimistic regarding the possibilities that mass self-communication features in producing meaning²²: “it renders possible the unlimited diversity and the largely autonomous origin of most of the communication flows that construct, and reconstruct every second the global and local production of meaning in the public mind” (CASTELLS, 2019, 90).

Let's try now to understand how mass self-communication renders counter-power viable, i.e., to what measure social

²² For a discussion about whether the media in itself exerts power or if it is only an intermediate element in power relations, cf. (COULDRY; CURRAN, 2003).

movements and political insurgency articulate by means of it. As stated above, counter-power consists in the capacity by social actors to oppose institutionalized power relations in society, eventually changing them. This clash is a permanent characteristic of societies, in place wherever there is a form of domination, be it political, cultural, economic, psychological etc (CASTELLS, 2019, 90). In this sense, together with the legitimacy crisis of the traditional political institutions, contemporaneity has witnessed the growth of a variety of social movements, whose source of inspiration and meaning for social organization projects and institutional reform is based, for the most part, on identity issues, involving ethnic, territorial, national, religious identities. Generally, such movements oppose institutionalized values under which they do not see themselves represented (which does not necessarily mean that their demands hold an inherently progressive character):

Very often, social movements and insurgent politics reaffirm traditional values and forms, e.g. religion, the patriarchal family or the nation, that they feel betrayed in practice in spite of being proclaimed in the forefront of society's institutions. In other words, social movements may be progressive or reactionary or just alternative without adjectives. But in all cases they are purposive collective actions aimed at changing the values and interests institutionalized in society, what is tantamount to modify the power relations. (CASTELLS, 2019, 90)

Mass self-communication allows for social movements to speak for themselves - and not through institutions of

communication media that would represent them from a point of view that is not theirs, thus allowing for them to autonomously present their own projects, in their own terms. A relevant example of this is the self-documentation project by Uru-eu-wau-wau indigenous people from Rondônia, northern Brazil. After the death of Aruká Juma, the last remaining entirely Juma person on the planet, in February 2020 due to the Corona virus, Bitate, a young indigenous community leader, descendant of the Juma and Uru-eu-wau-wau peoples, by way of mother and father, respectively, decided to close his people's territory to visitors. They later set up a team to document, by means of cameras, drones and other media technologies, how they survived for over a year with no serious instance of the disease²³. His words express the aspiration of his people of telling themselves their own history:

Self-documentation is an opportunity to record our own history, our own reality. There are many journalists who want to come over here, but who do not understand a thing about our way of life. This is a great opportunity for the indigenous peoples to learn how to make films in order to record the history of our people.²⁴

Txai Suruí – coordinator of Kanindé (Ethnoenvironmental Defense Association), of the Indigenous Youth Movement

²³ A short documentary produced only by filmmakers of the Uru-eu-wau-wau territory can be watched at: <https://www.youtube.com/watch?v=kyjbyu7M8Dg>. Accessed on June 1 2022.

²⁴ <https://brasil.mongabay.com/2021/06/povo-uru-eu-wau-wau-documenta-sua-vitoria-contra-a-covid-19-em-video/>. Accessed on June 1 2022.

of Rondônia, and column writer in Folha de São Paulo newspaper, one of the biggest printed newspapers in circulation in Brazil – makes a reference, in her participation in *The Climate Story Lab Amazônia*, to the project headed by Bitate, besides highlighting the role of technology and of communication in the struggle against the climate crisis and in the preservation of indigenous culture:

By means of communication we still preserve our culture and show the world the beauty and knowledge of the indigenous peoples, which features such solutions [against the climate crisis]. Solutions to really change and transform and provide an exit to this crisis. This crisis that is already hitting the whole world and whose consequences we are already suffering. And this does not show up in the traditional media, this is the truth. What we see, chiefly what is happening in the indigenous territories, is said by ourselves, through our autonomous media, through our communicators. We have Mídia Índia, Apib, Coiab²⁵. It is the indigenous communicators who are inside the territories speaking out to the world “look, gold prospecting is killing the people, here the invader is getting

²⁵ Mídia Índia: <https://midiaindia.org/>; Articulação dos Povos Indígenas do Brasil: <https://apiboficial.org/>; Coordenação das Organizações Indígenas da Amazônia Brasileira: <https://coiab.org.br/>.

through, here there is cattle inside my land". And who is doing most of this work? Youth²⁶.

Still on autonomy, it is worth adding that it is an inherent characteristic of the internet itself. It is correct that the project that originated it, the Arpanet, was developed by the US Defense Department – by means of the ARPA research unit (*Advanced Research Project Agency*). However, as Himanen wrote (2001, 183), the extension and the meaning of this governmental participation in the internet's beginnings tends to be exaggerated. According to this author, because university researchers have taken up, at that time, managerial roles, the development of the internet was driven by principles of self-organization, common to scientific practice. The most expressive achievements of this initial development were carried out by the *Network Working Group*, a group of hackers²⁷ formed by talented university students. The way they worked already looked like the open-source operational model.

²⁶ The fact that she mentions youth supports Castells' thesis that the conflict between generations, between young and adult, is sharp in our present day, especially because youth is a major enthusiast of digital culture, which implies a different way of thinking, because the space of communication in which we live and the way in which we communicate reflect the way we think. With new technological tools, the young self-communicate and inform themselves, and "since they have the capacity of being open to the world, they live in a world of global culture. The youth is really living globally at the same time they're living locally. While the adult world lives on local villages, on the important ones, on the ones they can survive, they can control" (cf. Castells - O poder da juventude é a autocomunicação (3:36), <https://www.youtube.com/watch?v=OL9c2h0TTL0>. Accessed on June 2 2022).

²⁷ Cf. definition of hacker given by Himanen (2001).

The Network Working Group operated on the open-source model: anyone was allowed to contribute ideas, which were then developed collectively. The source codes of all solutions were published from the very beginning, so that others could use, test, and develop them. (HIMANEN, 2001, 183)

Likewise, the World Wide Web – the hypermedia engineered based on the internet – was not created by a corporate or governmental fiat. Tim Berners-Lee, the person behind the initial project for the construction of the Web, relates:

Interested people on the Internet provided the feedback, stimulation, ideas, source-code contributions, and moral support that would have been hard to find locally. The people of the Internet built the Web, in true grassroots fashion. (BERNERS-LEE; FISCHETTI, 2000, 47)

We also have to acknowledge the social and community perspective that Berners-Lee projected for the Web:

The Web is more a social creation than a technical one. I designed it for a social effect – to help people work together – and not as a technical toy. The ultimate goal of the Web is to support and improve our weblike existence in the World. (BERNERS-LEE; FISCHETTI, 2000, 123)

In this sense, the mass self-communication technologies are not just a tool whose deployment allows social movements the autonomous development of their

projects, they are also a social construction, the product of a culture that emphasizes the individual's autonomy (CASTELLS, 2019, 91).

Furthermore, as we speak of the use of technologies, it is important to observe that, for the indigenous populations, the very domain of such tools represents a rupture with a place that is imposed on them by prejudice. Still in her talk at the *The Climate Story Lab Amazônia*, Txai Suruí mentions the case of a *bolsonarista* right-wing congressman from the State of Rondônia, Coronel Chrisóstomo (PSL), who, in an audience summoned to discuss the deaths of two indigenous children in an area of illegal prospecting within Yanomami territory, mocked indigenous culture stating that one cannot take an Indian with an Iphone²⁸ seriously.

And we have also been doing this work [of indigenist communication] in order to demystify the still colonized heads of people who think that we, indigenous peoples, can't have a cellphone, for instance. We saw the confusion yesterday [24.11.21] as a deputy called us fake. Why? Because we can't have an Iphone? And no, the indigenous communicators have been bringing this up and demystifying this idea, that the indigenous peoples can be wherever they want, and that we have the right to have anything we like. People still look at the indigenous peoples with a mean gaze, implying that we, the indigenous peoples, are poor, and that we have to live in misery.

²⁸ Cf. <https://www.diariodocentrodomundo.com.br/essencial/bolsonaristas-atacam-indigenas/>. Accessed on June 8 2022.

It is not incidental that a Brazilian parliamentarian makes a statement as prejudiced as that. At the end of the 1970's, the occupation policy of the Amazon region promoted by the then military regime intended to develop juridical tolls to allow the distinction of indigenous from non-indigenous persons, so that the State could cancel the special citizenship status of the "Indians who had ceased to be Indians". For the State, it would be enough to summon experts who, by analysis and ostent, would tell apart who was to be indigenous and who was not. Against this project, several organizations emerged or consolidated, such as the Comissão Pró-Índio, Associação Nacional de Ação Indigenista (ANAI), Centro de Trabalho Indigenista (CTI), Povos Indígenas no Brasil (PIB) - which is at the origin of the Instituto Socioambiental (ISA). Eduardo Viveiros de Castro (2006), indigenist anthropologist that has lived through all such events, wrote about that time:

Our political and theoretical aim, as anthropologists, was to definitely establish - and we didn't manage to; but I think one day we will - that to be Indian is not to wear a feather headdress, apply *urucum* paint and wield arrow and bow, something apparent and evident in this stereotyping meaning, but instead a matter of "state of mind". A mode of being and not a mode of appearing. Actually, something more (or less) than a mode of being: *indianity* designated to us a certain mode of becoming, something essentially invisible but no less efficacious: an incessant infinitesimal movement of differentiation,

not a massive state of “difference” preceding and stabilized, that is, an identity²⁹.

We made this brief digression just to elucidate that the mere use of technologies seen as modern, independent of what they are capable of doing, already bear a different meaning when indigenous populations are involved.

Let's return to the issue of mass self-communication. Besides allowing several social moments and different cultures to express by themselves their desires and demands, the peculiar characteristics of mass self-communication also encourage a phenomenon that Castells (2019, 92) denominates *instant political communities of practice*. This phenomenon is characterized by a reactive political insurgence, a spontaneous revolt prodded by indignation in face of oppression, of corruption or of the indifference of the elite in power. Generally, such revolts are sparked by a particular event, producing webs of protests that are set up from the use of the internet and of cellphones. Such mobilizations, which can take up gigantic proportions in a short time, have in their essence the use of horizontal mass communication networks. A few examples include the protests in Tunisia in 2011 that led to the deposition of the then president Zine El Abidine Ben Ali, to which one can attribute as a starting

²⁹ Excerpt of the interview with Viveiros de Castro to the editing team of the book *Povos Indígenas no Brasil*, on April 26 2006. Available at: https://pib.socioambiental.org/files/file/PIB_institucional/No_Brasil_todo_mundo_%C3%A9_%C3%ADndio.pdf, sob o título “No Brasil, todo mundo é índio, exceto quem não é”. Accessed on June 9 2022. Cf. also the article: Identidade brasileira, Available at: <https://www.academia.edu/84021322>. Accessed on May 9 2022.

point the self-immolation of street vendor Tarek el-Tayeb Mohamed Bouazizi, who set his own body on fire in response to the seizing of his belongings and to the humiliation and harassment from security municipal agents³⁰. With the same characteristics of a specific starting point and the numerous and spontaneous joining in processed by mass self-communication, we can also mention the May 2013 demonstrations in Brazil, headed by the Free Pass Movement (Movimento Passe Livre - MPL)³¹, whose origins are found in the increase in the public transport bus fares in the city of São Paulo.

The decentralized and expansive features of mass self-communication is reflected on the forms of political organization of the more recent social movements. As observed by Juris (2004, 349): "The internet does not simply provide the technological infrastructure for computer-supported social movements, its reticulated structure reinforces their organizational logic". Analogous to the communication technologies that they use, such movements appropriated the network format, so that its actions and practices are based on non-hierarchical structures, in the horizontal coordination among these autonomous groups, in the open access, in direct participation, in consensus-based decision making, in free and open circulation of information. Differently from the party or trade union politics, which operates by means of a vertical and hierarchical structure, based on

³⁰ For more information on the case, check https://en.wikipedia.org/wiki/Mohamed_Bouazizi.

³¹ For more information about Movimento Passe Livre, check https://pt.wikipedia.org/wiki/Movimento_Passe_Livre.

representativity, in the recruitment of new members and in the establishment of a hegemonic politics, the way of doing network politics works out by means of the expansion and articulation between different groups, collectives and other networks who converge to a point in common. This takes place through a flexible and decentralized organizational structure, which, besides interfering neither in the identity nor in the autonomy of the groups involved, renders viable wide ranging communication and coordination among themselves.

This reverberation of technology in the forms of political organization can be noted in the passage below, taken from a project elaborated by Coolab, a collective that works with the implementation of community networks in communities who face difficulties in accessing communication networks:

As a result, the strengthening of the associativist process of the selected communities is expected, securing self-management and sustainability of the community providers created. Coolab seeks further to stimulate the decentralization and the appropriation of this methodology by other groups, acting locally. In order to do so, we followed the premises in the use of free software, as well as carried out documentation of the methodologies and technologies used (Sic)³².

³² Taken from <https://transforma.fbb.org.br/tecnologia-social/coolab>. More information about the collective at: <https://www.coolab.org/>. Both links accessed on May 9 2022.

It is interesting to note in this quote how the notions of decentralization and sharing related to the concrete space of political organization – in this case, the communities where community networks are set up – are thought of as a consequence of the directives that define the use of free software.

Analogously, like the structure of the network technologies increasingly manifest in political organizations, network societies demand new network technologies. There is, as Welman clarifies below, a positive feedback between these two instances:

The technological development of computer networks and the societal flourishing of social networks are now in a positive feedback loop. Just as the flexibility of less-bounded, spatially dispersed social networks creates demand for the world wide web and collaborative communication, the breathless development of computer networks nourishes societal transitions from little boxes to social networks. (WELLMAN, 2001, 228)

Another important characteristic is that the frontiers conditioned by space-time are rearticulated in the network society. To bring people together does not imply necessarily in them being in the same space at the same moment, because data travels in the network for long distances and on principle are always available on demand. But despite this virtualization possibility, that works without presential meetings and assemblies, the social movements, besides using the communication technologies to organize direct actions and coordinate

campaigns, do not cease to act locally and presentially. In this sense, it is worth bringing up the term “glocal” (JURIS, 2004, 347; HAMPTON, 2004, 226; WELLMAN, 2001, 236), which can be used to designate the at once global and local action mode of such movements, since a local action, as it enters the information flux of the communication networks, acquires the potential of global reach: a protest organized to take place in certain city can be replicated, from the sharing of sources and information – possibly in real time – in any part of the world.

All such factors brought together form, ultimately, an amalgam composed by the technological infrastructures, the data that travels in them and the people who use and feed them. The confluence of these elements constituted what Pierre Lévy defined as cyberspace:

Cyberspace (which I will also call “network”) is a new communication medium that emerges from the worldwide connection of computers. The term specifies not only the material infrastructure of digital communication, but also the human beings who navigate and feed this universe. (LÉVY, 1999, 17)

And as we remarked earlier, cyberspace establishes conditions that make room for new practices, values and ways of thinking – that, all together, we can define with the term *culture*. In this context, the MariaLab project is illustrative. This is a feminist collective that seeks to rebuild and reappropriate the way in which we develop and interact with technological infrastructures. The following passage, taken from the primer *Weaving Care Territories: a guide for the learning and construction of community*

networks, gives us a good example of how appropriation of a technique or of a technological infrastructure is manifested in culture and vice-versa:

There are guides that seek to work out all the phases [technique, governance, training]. Other materials separate the technical work from the educational or political work. This role division often reproduces gender roles so common in our society. Men configure the equipment and women take care of the learning process.

This split does not interest us. We are women and we want to talk with women, in all phases of the process, aware that technology is political. As feminists we deny that the different knowledges can be hierarchized in a way where 'technology' is reduced to digital technical knowledge in opposition to other processes. We do not believe, also, that the role of manipulating digital technologies belongs to men and that the roles of caring for the learning process, of articulation, of food and other technologies necessary to the implementation of a community network are necessarily feminine roles.³³

In this excerpt, we notice how cyberspace sets up conditions for the culture where it is manifested to be confronted and reconfigured. The building and use of a technological infrastructure - a wi-fi community network - propitiates the conditions for the issues of *machismo*, gender inequality and arbitrary hierarchies to be

³³ The primer is available at <https://www.marialab.org/infraestructuras-feministas/>. Accessed on May 12 2022.

challenged. Thus, simultaneously to cyberspace there is the set of practices and values that are developed alongside it, or better said, there is cyberculture, as defined by Lévy:

Regarding the neologism "cyberculture", here it specifies a set of techniques (material and intellectual), of practices, of attitudes, of modes of thinking and of values that are developed together with the growth of cyberspace. (LÉVY, 1999, 17)

Following the same author, it is important to mention that cyberspace does not determine the culture or the society where it takes place, but only conditions it. Even if technique follows, translates and favors the developments of a civilization, it would be too much to state that a society is determined by the emergent form a specific culture. As exemplified by Lévy, the invention of spurs has given birth to a new mode of cavalry, which has driven feudalism's political and social structures. However, this does not allow us to state that the invention of spurs is the cause of feudalism, despite the fact that, if spurs did not exist, it would be difficult to imagine how the knights in armor would ride their battle horses, how the cavalries would have been set up, how wars would have been conducted etc. A state of a social or cultural fact is fruit of a complex and "partially undetermined" process of interactions, which practically renders nonviable identification with a precise cause. Thus, we can say that spurs indirectly condition feudalism, but do not determine it. That is, to state that technique conditions a certain social fact means to say that some possibilities could not "be taken seriously" if this technique didn't exist, but this does not mean this fact

would not exist if there wasn't such technique; or, still, there are social facts that could have existed - given the possibilities opened by this technique - but that did not consolidate and we did not even imagine them (LÉVY, 1999, 25).

Following this reasoning, we can say with Castells that technology in itself does not play a determinant role in social transformations, however political and social autonomy, fundamental element for a social and cultural transformation, are related to the communicational autonomy rendered viable by the new communication technologies:

[T]echnology per se does not produce cultural and political change, although it does always have powerful effects of an indeterminate kind. Yet, the possibilities created by the new multimodal, interactive communication system extraordinarily reinforce the chances for new messages and new messengers to populate the communication networks of society at large, thus reprogramming the networks around their values, interests, and projects. In this sense, the construction of communicative autonomy is directly related to the development of social and political autonomy, a key factor in fostering social change. (CASTELLS, 2009, 414)

Next, we analyze separately a few open-source digital infrastructures that we have studied in the course of this research. Taking into account the classification proposed by Eghbal (2016, 46) with regards to how digital open-source infrastructures are organized and are funded, that is,

considering the categories that she proposes: *Within a company*, *As a new business* and *By individuals or a group of individuals*, we can say that all the project I investigated can be framed in the last classification.

A project within this category is characterized by being developed mostly by individual contributions, by featuring a decentralized work method, and by been self-organized, devoided of strategies and explicitly defined and shared missions (LINDINGER, 2020, 5). And specifically in the case of the projects we investigated, most of them are developed within non-profit organizations (not directly related to the development of digital infrastructure, but to socioenvironmental causes), which at a certain point employ digital technologies to improve the carrying out of their aims.

SMART

On October 15 2021, we interviewed Felipe Spina Avino, in charge of the Technologies for Conservation section of WWF-Brasil. He told us about SMART³⁴ (*Spatial Monitoring and Report Tool*), an open-source digital platform that involves many tools, from a cellphone app to cloud data storage. The system was created in 2011 and its development and maintenance involve a partnership between several organizations: *Frankfurt Zoological Society*, *Wildlife Conservation Society*, *North Carolina Zoo*, *Panthera*, *Peace Parks Foundation*, *Wildlife Protection*

³⁴ <https://smartconservationtools.org>

Solutions, *Zoological Society of London*, *Re:wild* and the WWF. With the support of the *Gordon and Betty Moore Foundation*³⁵, in 2019 the platform was introduced in the country by means of the WWF-Brasil, which besides offering training workshops, translated the system and manuals into Portuguese and Spanish.

SMART allows for the integration into a single system the field work, the data analysis work and the production of reports. With *SMART Mobile*, users collect field data, such as information about biodiversity, illegal activities (deforesting, prospecting, invasion, hunting), patrol routes etc., and record it in a central database, the *SMART Desktop*, where the raw data is analyzed and transformed into reports useful in the understanding and documentation of what is taking place in the territories visited. SMART can be personalized for specific needs and contexts, able to adapt to marine or terrestrial territories and to places with or without internet connection. And besides its architecture favoring integration with other databases and applications, its functionalities can be widened by means of several plugins, such the *SMART Survey*, which tracks changes in the monitored entities, thus allowing the evaluation of the effectiveness of the implemented action strategies. Felipe analyzes in the following manner the role played by technologies similar to SMART:

Mobile phones can be great allies to conservation, and provide a wide range of relevant data facilitating the management and protection of Forest, and

³⁵ <https://www.moore.org/>

engaging diverse actors in this process such as tourists and local communities. We know that, unfortunately, there is a lack of sufficient resources for effective management and safeguard of protected areas, but technology can help us to know where to focus and how to better apply the existing resources to achieve favorable results and ensure the conservation of these areas.³⁶

Felipe told us about the SMART implementation project in Rondônia, a Brazilian northern state. The project was carried out by means of a partnership between the Moore Foundation and the Kanindé Ethnoenvironmental Defence³⁷. Its aim is to reduce the invasion and deforesting of indigenous lands, besides increasing the capacity of prevention and denunciation of illegal activities in these territories. The project is divided into different levels: more generally, a remote monitoring center via satellite covers all the indigenous lands in Rondônia; locally, indigenous teams monitor four territories with the help of SMART: Uru-Eu-Wau-Wau, Igarapé Lourdes, Pacaás Novos, Sete de Setembro³⁸; and to deal with issues related to bureaucracy and communication, there is a team of institutional character composed by lawyers and communicators, in charge of transforming the collected data into information useful to the control agencies and to the Press, so that the

³⁶ <https://www.wildlabs.net/discussion/world-first-workshop-spatial-monitoring-reporting-tool-smart-portuguese-takes-place>. Accessed on June 18 2022.

³⁷ <http://www.kaninde.org.br/>.

³⁸ O SMART has also been used in the monitoring of the conservation units of the Amazon region, the Sustainable Development Units of Uatumã and Uacari, plus the State Parks of Matupiri and Sumaúma. Cf.: <https://plenamata.eco/2022/01/13/smart-ferramenta-apoio-gestao-areas-protégidas/>. Accessed on June 14 2022.

violations found in the field gain visibility and are adequate in the progress of juridical suits resulting from the denunciations recorded.

Each village has a monitoring team. Among the Uru-Eu-Wau-Wau, for instance, the team is composed by more or less five people – indigenous men and women –, who besides being aware of personal safety tactics, were trained in the use of SMART and drones. They go on surveillance rounds once or twice a month: they go out in expeditions that may last to two or three days and they go to the extremes of the territory, collecting and recording data during the process. Up to the moment of the interview, the group was waiting for an update of the alert system via satellite. More sensitive than the version then in use, it was possible to detect deforesting events in their initial stages – the moment when loggers started to open the first track, for instance – so that they can be interrupted before they evolve to a more advanced state of destruction. Furthermore, as related by Felipe, the early warnings are important because the State is practically inoperative regarding the punishment of infractions already carried out.

There are infractions, however, that a satellite is not able to detect, such as selective cuts of wood or trail opening, which underlines the importance of local expeditions. In face of a notifiable fact, photographs, local GPS coordinates, textual observations and even audio or voice recordings can be collected by means of SMART. All this data is stored in the smartphone and can be shared as soon as a network signal is available. In this sense, the implementation of HERMES is being tested in the Uru-Eu-

Wau-Wau village. HERMES is an open source digital data transmission system by means of radio short wave/HF, about which we write more below. Despite the fact that transmission is slow, especially when image files are concerned, this is enough to describe and to collect evidence of what is happening, so that it will be possible to react according to what the situation demands. According to Felipe, this way of action has shown to be effective. In a few cases, the infractions were surprised in *flagrante delicto*, which demands subsequent actions (when tensions and risks involved are not to be neglected), such as notifying the Federal police or negotiate for the criminals to leave the site.

During the SMART implementation in Rondônia, several workshops were carried out, especially to detect the local specificities and priorities, which later are reflected on the app's personalized configuration, adapted to the users' reality. Felipe stresses the collective work with the communities:

We did the workshops with the indigenous people first to understand which were the threats, what was important for them to monitor, what kind of datum made sense. Then, further on, we brought in our legal people, to comment on what kind of information cannot be left out from the juridical point of view regarding a case to be built further ahead. It's been a collective creation project.

In the case at hand, the Kanindé people worked with the SMART team, and both defined the relevant categories, that is, data modeling, "which is basically the information

collection form”, besides defining elements of the graphic interface, so as to produce a friendlier usability on the field. After this initial configuration, the SMART manipulation becomes very automated. The application automatically generates, based on the collected data, reports and maps according to the previously configured categories.

Besides the possibility of personalization, Felipe highlights two further important features in SMART. The first regards security and privacy: data management is in the community's full responsibility. Data can be shared or shown on the internet, however, this takes place by means of the explicit deliberation of the user, that is, the application in itself does not make malicious use of the information entered. The second point regards being free of charge and also its periodic maintenance. As SMART is maintained by a group of non-governmental group, this gives it wide financial sustainability, allowing it to be constantly updated, to have plenty of material support and to offer translations into several languages. Felipe says they always give preference to free or low cost open-source tools when a project is implemented, so that it can be more easily replicated in other territories, with limited budgets.

A symptomatic characteristic of NGOs is the difficulty in conciliating the aims, usually involving long duration actions, and the restricted deadlines approved in projects by funding bodies (BANKS; HULME; EDWARDS, 2015). This is reflected on the maintenance of applications. As related by Felipe, several apps are not sustained in the course of time because they cease to get maintenance when a project's funding closes. This issue was a concern in the meetings organized in 2020, where various NGOs that

have applications got together to discuss how to better work in tandem, so that the projects could converse with one another. A movement in this direction has been articulated by means of the construction of the monitoring system of the Coordination of the Indigenous Organizations of the Amazonian Cuenca (COICA³⁹), a project that intends to gather data originating in the apps used by several other indigenist organizations.

HERMES

As mentioned above, in some communities SMART has been implemented in tandem with HERMES⁴⁰, a digital data transmission system by means of short wave/HF. We had the opportunity to talk with Rafael Diniz⁴¹, lead developer and project manager at *Rhizomatica*, an organization of which HERMES is presently part.

Rhizomatica is non-profit and was created in 2009, with the aim of setting up telecommunication infrastructures in communities that, due to many factors such as oppressive regimes, threat of natural disasters, infrastructural precariousness etc, find themselves isolated from communication media. Besides HERMES, the organization is involved in other projects, such as community cellphone

³⁹ <https://coicamazonia.org/>.

⁴⁰ <https://www.rhizomatica.org/hermes/>.

⁴¹ We talked to Rafael in two occasions: on the same day we interviewed Felipe of WWF-Brazil/SMART, and in the online dialogue rounds, on December 16 2021, when were also present Silvio Carlos (Instituto Socioambiental/Alertas+) and Rafael Naka (Centro de Trabalho Indigenista/Mapa Guarani Digital).

systems, mesh wi-fi networks, research and development of free/open source hardware and software. It also develops projects of juridical character, aiming to help small communities in the operation of their autonomous communication systems – for instance, the legalization of access to frequency bands, regulation of communication infrastructure and demands for funding. The focus of such work has been Latin America, with projects carried out in Mexico, Colombia, Ecuador and Brazil.

HERMES's main objective is to allow digital communication by means of short wave High Frequency transmissions. The advantage of this type of transmission is the possibility of connecting, without the use of satellites, cables or any intermediate system, very distant points, as far as one thousand kilometers away. In the Terra do Meio region for instance, in the State of Pará, there is a connection carried out with HERMES that reaches as far as about 500 kilometers. This long reach is relevant, especially as a cellphone tower covers an average of 30 kilometers, that is, any community away more than 30 kilometers from an urban center, a distance easily surpassed by Amazon region communities, will have no access through a telephone network. Faced with that, Rafael says that when he thought about a digital data transmission system for communities sited in rural areas or in the forest, the idea of using short wave cropped up naturally, since in a large portion of such communities the only communication means is the short wave transceptor radio.

HERMES' origin harks back to the project *Juruá Fonia: communication networks for peoples of the forest of Marechal Thaumaturgo/AC*, formed by researchers of the

areas of anthropology and computer science, and by dwellers of the High Juruá Extractivist Reservation, sited in the border of Brazil and Peru. With this project, which took place in 2015, one tried to respond to the demand for a communication and information infrastructure that helped in the territorial and environmental management, as well as in the reversion of the social degradation caused by the isolation, both within the communities themselves and in relation to their relatives who live, study or work in the distant municipality's headquarters. Within this scope, the first digital data transmission test was carried out by means of a short wave band: a photographic image was sent between the city's station, at the headquarters of the Association of the Rubber Tappers and Agriculturists of the Extractivist Reservation of the High Juruá, and a station placed at the mouth of the Breu river, distant about 50 kilometers (CAMINATI; DINIZ, 2015, 2).

In 2018, HERMES gained fresh drive as it won the first prize in the competition⁴² promoted by the Mozilla Foundation, whose aim was to foment projects that present solutions for communication challenges in contexts of disaster or in communities with precarious access to the internet. With HERMES then part of Rhizomatica, on the occasion the system transmitted in the HF band SMS messages and voice recordings, connecting the capital of Oaxaca, in Mexico's south, to a community sited in a mountain vale in the same state. Locally, users connected to a GSM network provided by a small radio station. In 2019, the system gained an update, so that the services provided by the HF network were now accessed through a local wi-fi network,

⁴² Mozilla Wireless Challenge: <https://wirelesschallenge.mozilla.org/>.

thus allowing the sending and receiving of photos by means of a cellphone (DINIZ; FARIAS, 2021, 3).

Besides, at the end of 2021, when we interviewed Rafael, HERMES already relied on the development of its own hardware, so that it no longer relied on an “off-the-shelf radio”. The device, basically a box containing a computer and a HF transceptor, is a radio optimized to transmit data. Its construction is modular, so that a damaged piece can be changed independently, with no interference in the functioning of the others. Each device costs an average of a thousand dollars. There are also the devices that compose HERMES’ installation infrastructure, many of which are the same required for the installation of a traditional radio. A node in the HF band network in the forest region, for instance, typically requires a solar panel, a charge regulator, posts for the support of the antenna, the antenna, a cable to connect the transceptor to the antenna and the transceptor for the HF band connected to a computer (DINIZ; FARIAS, 2021, 3). As Rafael says, while it is not cheap, it is a low cost equipment, especially when one considers other digital data transmission options. A satellite internet, for instance, besides featuring a high installation costs, demands a monthly expenditures with the company that offers the service. Furthermore, it is noticeable that the value of approximately one thousand dollars is the equivalent of the price for a radio communicator. In this way, to install HERMES is, in any case, more advantageous than installing just a common radio, since the system can also function like one – which, as mentioned above, is a very popular communication system in the Brazilian Amazon region.

We can further list HERMES' following advantages, which are similar to those in the use of a radio in comparison with a usual telephone or internet system offered by the big telecommunication companies: a) HERMES' stations enjoy energetic autonomy, since they can be fed by a system of simple solar capture; b) a large part of the devices composing the system – transceivers, antennas, batteries, are more robust, durable and demand less maintenance than the notebooks and cellphones that, besides, are usually submitted to the logic of programmed obsolescence; c) as stated by Caminati & Diniz (2015, 4), rural or forest communities, in principle, could seek the installation of the internet in their territories by means of some public policy to promote access to communication means. However, the politics of mediation involved in such process, needed for the set up and maintenance of the infrastructures, often amounts to a barrier for these communities.

In face of such points, HERMES' independence and autonomy stand out as its chief advantages. This is particularly relevant when security issues are considered. Felipe relates the case of a community where invaders sabotaged, more than once, the cables furnishing energy and the internet, leaving dwellers vulnerable without communication. Thus, he observes that, as a strategy issue of security, it would be interesting to have the HERMES system set up even in communities that already have the internet, for in similar situations they would still be able to communicate.

Another point that relates to the issue of security regards respect to privacy. In a usual internet connection, there is

need for a company mediating the full data transmission process, so that it can make use of such information to the detriment of the user; in the case of radiophonic activity, calls can be intercepted by third parties. With HERMES, in contrast, the transmitted data is cryptographed, only the receiver can interpret it. In a HERMES presentation video⁴³, made by Rhizomatica, there are two users of the system highlighting this point: Francinaldo Lima, aide of the Association of the Dwellers of the Terra do Meio Extractivist Reservation, notes the privacy in communication, especially when information is exchanged regarding threats to the territory, bringing more safety to the community; Raimunda Rodrigues, riverside dweller of the Iriri river and manager of the Rio Novo mini-plant, says that to exchange information through conventional radio about the management of the nuts stock, at the plant or in the canteen, causes a risk of theft, which has ceased to happen with HERMES' cryptographed data transmission.

One of HERMES' disadvantages, though, is the low transmission rate. As an illustration, in order to transmit 80 kilobytes in short wave takes in excess of 10 minutes. In this way, messages are limited to the maximum size of 20 kilobytes, and the transmission queue is configured to a limit of 80 kilobytes. So the data transmitted goes through compression codifiers that use machine learning. For instance, LPCNet is used, a computational neural network developed by the Mozilla Foundation to codify voice data at a rate of 1.600 bit/s. Despite demanding greater computational complexity, the result bears a better

⁴³ <https://vimeo.com/398331581>. Accessed on July 9 2022.

subjective quality when compared to the result of codifiers that do not feature machine learning.

Notwithstanding such limitations, it should be born in mind that HERMES is not exactly an internet access system – with which one can watch videos, have online meetings etc., but a bridge to it. Caminati & Diniz (2015, 2) clarify this point:

It is a fact that the bitrate that this coupling offers does not allow for the transmission of very big files, and also could not be used as a replacement for access to the internet. But it does contain huge possibilities of application in local services and even of integration with internet services. We haven't been able to deepen such potentials, but in conversations during the tests and during workshops, when we presented them, we realized two main fields of application in services: remote education and geoprocessing – the latter deeply important for territorial and environmental management.

The integration with SMART, seen above, was witness to an advance regarding the use of the system as a geoprocessing tool.

Sending emails figures among HERMES' main functionalities. In order to carry it out, the open-source software Delta Chat⁴⁴ is used. HERMES also has a web mail service installed, which can be accessed through the wi-fi network created by the station. However, due to practicality and to the friendlier interface, similar to a message

⁴⁴ <https://delta.chat>.

exchange app⁴⁵ such as *WhatsApp*, *Signal*, *Telegram*, the use of Delta Chat is being recommended. Working as an email client, it allows for the user to send from the cellphone text messages, audio, images and files. In this manner, a basic flux of data would be: the user connects the cellphone to the local wi-fi network created by HERMES and sends a message by Delta Chat; this is then treated locally, where it goes through the compression process, for instance, and is then routed through the short wave transceptor to the HERMES station that is in some point with access to the internet; from then on the message is sent to its final destination. Thus, any HERMES station can send (receive) data to (from) any part of the world, provided there is at least one station with access to the internet.

The topology of the network is a star, so that a central station, placed in a point that can offer adequate infrastructure for internet access, is connected by short band to every other station. In normal operation, the central station periodically connects to the other stations – every hour, every two hours, depending on the community's conditions and needs – and synchronizes emails. As the reach of the connection is quite long, there is no need to make a bridge, like a mesh network, between stations: the central station is able to directly reach any other station.

⁴⁵ This point is very important regarding a good user experience. Users accept more easily an app when it resembles the apps most used by the communities. An example is the *Proteja Amazônia* application (object of one of my case studies), whose interface had to be reformulated so that it looked like WhatsApp.

According to Rafael, this is how they have envisaged the HERMES' installation up to now carried out. However, nothing stops a peripheral station requesting from the central station an immediate synchronization, in the case of an urgent message, for instance; or that a station may directly connect with another, establishing communication independent from the central station:

Through the radio's web interface you [...] are able to send ad hoc messages, let's say, without using the email transport. You want to send it to station x as if it was a bulletin board. [You] can send a message directly to a radio and it will pop up in the other radio's web interface as a bulletin board. (Rafael Diniz, interview on October 15 2021)

In the web interface – accessible by the user's cellphone or computer – it is also possible to configure the radio's frequency, output potency, radio mode (USB or LSB); the potency amplifier can be switched on or off (in case it is operating with low battery or in a proximity that does not demand amplification), users can also be created, passwords configured etc.

The advantage of not using the other stations as bridges is not having to use up the stations' battery that, in the after all, would be operating just to intermediate the connection. Another point that should be taken into consideration regards the distribution of frequencies. If immediate synchronization with the central station is requested in the moment when it is synchronizing emails with any other station, this connection will collapse, because for each network there is only a single frequency. In this case, the

connection will not be set up until there are only two stations in communication. Likewise, attention is needed so that common radio communication is not made in the same frequency as HERMES is operating. There should be, therefore, planning for the use of frequencies, so that the frequency of the digital transmission does not suffer interference from the analogical transmissions or vice-versa.

Alertas+

A myriad of data produced in the context of the monitoring *Amazônia Legal*⁴⁶ is produced daily. Information comes from several sources⁴⁷ and bring in data on the climate, deforesting, forest fires, prospecting areas etc. Because of the amount and dispersion of such data, it is difficult for a non-specialist to form a general and cohesive understanding about what is going on in the Amazon region. It is in this context that the Alertas+⁴⁸ platform comes in. It was conceived by the Instituto Socioambiental

⁴⁶ *Amazônia Legal* (Legal Amazon Region) encompasses the totality of the states of Acre, Amapá, Amazonas, Mato Grosso, Pará, Rondônia, Roraima and Tocantins; and part of the state of Maranhão. Its area corresponds to 61% of the Brazilian territory (5.217. 423 square kilometers), despite only featuring 12,31% Brazil's inhabitants (AMAZÔNIA LEGAL. In: WIKIPÉDIA, a enciclopédia livre. Flórida: Wikimedia Foundation, 2022. Available at: <https://pt.wikipedia.org/w/index.php?title=Amaz%C3%B4nia_Legal&oldid=63836771>. Accessed on July 14 2022).

⁴⁷ Like DETER and PRODES, both of the INPE (<http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/deter/deter>, <http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes>), the SAD, of IMAZON (<https://imazon.org.br/publicacoes/faq-sad/>), and MODIS, of NASA (<https://modis.gsfc.nasa.gov/>).

⁴⁸ <https://alertas.socioambiental.org>.

(ISA)⁴⁹. This is an online dashboard that tracks and filters several alerts of environmental degradation in indigenous lands and in conservation units of the *Amazônia Legal*. With it, a user can, for instance, generate a graph informing the evolution of local prospecting alerts during a certain stretch of time and in a certain indigenous community.

According to Silvio Carlos – who was part of the platform’s conception, development and programming team, and with whom we had the opportunity to talk with during the round of dialogues we carried out on the September 16 2021 – there is a recurring difficulty in making estimates in different spatial and temporal profiles on environmental degradation in the Amazon region. Faced with this situation, Alertas+ sought to create a generic engine of statistics and estimates based on the already available and daily updated data about the Amazon region, so that the common user, the Press or other organizations may produce informative content – in a language accessible to a wide audience – without dealing with complex calculations. Thus, from a variety of classificatory criteria, which filters data coming from several trusted sources, the system produces totalizing graphs according to the profiles stipulated by the user.

In the occasion of the platform’s launch (August 10 2021), in a live⁵⁰ broadcast in the Instituto Sociambiental’s Youtube channel, Antonio Oviedo, researcher and coordinator of ISA’s Protected Areas Monitoring Program,

⁴⁹ <https://www.socioambiental.org/>.

⁵⁰ The live was recorded and is available at: <https://www.youtube.com/watch?v=yFMXbdxQ-oQ>.

and who is part of Alertas+ technical coordination, underlined three necessary elements for society to enjoy transparency and social participation mechanisms, so as to make adequate environmental decisions: a) to know the environment and the threats from anthropic activities; b) actively participate in the formulation of public policies and follow their implementation; c) enjoy the conditions to denounce environmental crimes. Antonio adds that, recently, the Access to Information Law and the Open Data National Policy were passed, forcing governmental bodies to produce and publicize information on the environment. Furthermore, besides the right to the ecologically balanced environment being secured by article 225 of the 1988 Federal Constitution, the Environment National Policy defines the production and communication of information as one of its aims.

In recent years, though, all this legislation has been under threat. There is a deliberate dismantling of the territorial and environmental monitoring agencies, a condition that is reflected in the expressive worsening⁵¹ of data on deforestation and forest fires, especially in the Amazon region. In addition, there is an information blackout, a decrease in transparency and social participation. According to Antonio, in order to overcome this situation the State needs to fulfill its constitutional responsibility, which involves, among other things, to promote qualified information and strengthen the environmental monitoring agencies with adequate teams and budgets.

⁵¹ <https://imazon.org.br/imprensa/amazonia-ja-perdeu-mais-de-2-mil-campos-de-futebol-por-dia-de-floresta-em-2022-maior-devastacao-em-15-anos/>.

We have observed in our research as a recurrent complaint the allegations about the limits in the actions that the organizations face before the state infrastructure, which, ultimately, should play the role of adequately processing the denunciations of violations of social or environmental rights. In independent conversations we had with Carolina Marçal, then member of Greenpeace's⁵² campaign sector, and with Paula Bernardi, Country Coordinator Brazil, of Hivos⁵³, a common point raised was the difficulty in securing favorable juridical development to those denouncing violations of environmental rights. What unfortunately takes place is that few denunciations are actually investigated, and when they are, rarely they reach beyond the first instance. Besides, the criminalization of the indigenous peoples is more intense than the carrying out of democratic access to justice by original peoples – Bernardi highlights. Ane Alencar, science director of the Amazonian Research Institute (IPAM)⁵⁴, in the occasion of the Alertas+ launch also commented on the situation: “What I feel is that the indigenous peoples are on their own, they are not completely alone because we stand with them, but they are sidelined by the government”. Trying to deal with this problem, many organizations are bringing jurists and communicators into their teams, as we saw with Rhizomatica and in the SMART implementation workshops in Rondônia. Thus, the data collected by the apps have greater chances of promoting wider public commotion or of becoming more pressing juridical evidence.

⁵² <https://www.greenpeace.org/brasil/>.

⁵³ <https://hivos.org/>.

⁵⁴ <https://ipam.org.br/>.

In any way, as in the points raised above by Antonio Oviedo and how we have tried to demonstrate in the theoretical grounding of our research, democratic communication and free access to information are indispensable elements – though not sufficient – for any action that seeks to result in deeper reforms. Alertas+ contributes towards that. One of its prerogatives is to make the data produced by the research institutes more accessible, as there is a chasm between research and the production of such information, its publicizing and understanding. In this sense, the dashboard seeks, from the data requested, to create consistent and communicative narratives, illustrated by infographs and presented in an intuitive language – the results about the dimensions of a devastated area can, for instance, be expressed in measure units that estimate the equivalent amount of felled trees or the equivalent size to soccer fields.

For Silvio, Alertas+ is an answer-generating machine. Due to the possibility of creating practically inexhaustible combinations of criteria, hypotheses can be raised or interpretations can be better grounded. In this way, as important as getting an answer is to discuss what would be interesting to ask the machine:

We want to improve, so to speak, the educational side of the system, so that it is easier to seek data, so that it is easier to understand which questions people want to make, because we have created, basically, an answer-giving machine. We may remember the quote attributed to Pablo Picasso saying computers

are useless because they only give answers, so we created an answer-giving machine. We need now to discuss and better translate how the questions can be made, what are the interesting questions (Silvio, in the Alertas+ launch live).

If, for instance, we look in the dashboard the fire spot alerts for the month of August 2019, restricted to the fires in the State of Pará, we realize that what was known as the Day of Fire⁵⁵ in fact amounts to a whole month when fire alerts much increased. Besides, all this information can be accompanied by various comparisons - previous periods, surrounding areas, proximity of conservation areas etc -, giving a more understandable perspective on the dynamics of environmental destruction.

When asked about the system's usability - if there has been a communication initiative between developer and user -, Silvio clarified that as the project relied on a small team, which should carry out the assigned budget as soon as possible, it was not possible to pay special attention to issues of usability and interface. So the more well-known open-source libraries were chosen, aiming at a generic solution, able to encompass different user profiles. Besides, the dashboard works in different modes,

⁵⁵ On the August 19 2019, at three in the afternoon, the city of São Paulo (sited over 2500 km away from the Amazon region) got as dark as if it was night. This took place due to the smoke from the forest fires in the Amazon region, which peaked - an increase of 1.923% in the number of spots in relation to the same period last year - between the 10th and the 1th of August, especially in the municipalities of Novo Progresso, Altamira and São Félix do Xingu. Such fires are attributed to criminal coordinate action by the region's rural producers. Cf. <https://www.greenpeace.org/brasil/florestas/dia-do-fogo-completa-um-ano-com-legado-de-impunidade/> e <https://g1.globo.com/sp/sao-paulo/noticia/2019/08/19/dia-vira-noite-em-sao-paulo-com-chegada-de-frente-fria-nesta-segunda.ghtml>. Accessed on 21.7.22.

progressing from the basic – more narrative, with images and infographics for the display of data – to the advanced, in which the more experienced user can call up an articulation of data as he or she seeks a hypothesis or a piece of evidence:

Our system basically vomits a huge amount of data. You need to know exactly what question you want to make, otherwise you will not understand the answer. So we decided to work first on these access levels... A very initial profile, then a basic presentation mode and a few more advanced profiles. (Silvio, in the community call on December 16, 2021)

Still on usability, Silvio brings attention to an episode that took place in another of ISA's projects, Xingu+⁵⁶, which consists in a map system of the region of the Xingu watershed used – also in printed form – in the making of deforestation bulletins: the users of the Xingu community always turned the maps upside down, because, differently from the way it was drawn, they see the watershed from the river Xingu riverhead outwards. This led Alertas+ to question the map library:

A debate we have is how do to take such map libraries and turn them upside down and change the projection. We are using the Web Mercator, which is an eurocentric, mercantilist projection, essentially colonialist. Then inside our socioenvironmental maps, with other initiatives we are seeking... I don't know.... decolonisation, or some other type of

⁵⁶ <https://www.xingumais.org.br/>.

interaction with the world, we are essentially placing there a library that is open source, that all the community uses, but the paradigm of such libraries is a mainstream paradigm (Silvio, in the community call on December 16, 2021)

As a result, a module within Alertas+ was created, where it is possible to alternate to the Fuller⁵⁷ projection, where the Earth is represented as it were a single continent surrounded by the ocean. Notwithstanding, Silvio observes that in this process the development team realized the enormous difficulty that is to develop and maintain the new library. It is a lot less labor-intensive to resort to ready-made libraries and just make the necessary adaptations.

In this sense, Silvio believes that a solution would be to foster union between organizations, who for several reasons - among which competition for funding - always end up reinventing their libraries and systems, rendering it more difficult to carry on with the development of projects:

At ISA, we started with a library that we call eco map - which is an open map library, based on other libraries too - with this aim of trying to unify all the socioenvironmental cartography systems, using a single library. And then we would somehow manage to build a pool, bring organizations together to get funding and suddenly foment a convergent development. (Silvio, in the community call on December 16, 2021)

⁵⁷ Cf. https://en.wikipedia.org/wiki/Dymaxion_map.

We asked Silvio if the Alertas+ source code, which is open/free, had received any voluntary contribution, which has not taken place. According to him, this is the case when a software starts to get used with great relevance. Besides, contributions are not given spontaneously, active network efforts are needed to foment initiatives in this direction. In any case, despite the project not having been able to raise contributions, Silvio says that they had “opened the source as a necessary ethical point”.

Asked by one of the participants in the community calls about what is, in general, the profile of the funders who support projects along the lines of Alertas+, Silvio clarified that they are not funders linked to issues of technological infrastructure, but linked to socioenvironmental causes. In this way, the technological infrastructures end up being seen as a means to – contingent in a way – to solve an urgent singular aim. For Silvio, this kind of vision hinders looking at the technological infrastructure itself, from which other relations could be built and break with infrastructures that are harmful to the communities. He argues that with a short term and merely reactive perspective:

we end up using any solution that works today in order to try and solve emergency problems. And in the case of Alertas+, in my understanding, what drove the funding of this round of development, the creation of our system, was the Day of Fire episode, in 2019, in August. [...] We had no way to react to a threat this big, in such a short time. And then came the funding. But it is not ideal for this kind of situation, because this tends to create inflated systems: a lot of investment in a short time, but

without a concern for sustainability. Then I think that this is a classic problem of institutions, living off funding. (Silvio, in the community call on December 16, 2021)

This stresses a major characteristic of our study cases. The technological infrastructure is not considered in itself, as a place from which social relations or other types of infrastructure could be thought afresh. Despite projects like MariaLab and Rede Mocambos, in which cyberculture itself constituted the transformation space, most of the projects we analyzed – SMART, Mapa Guarani Digital, Alertas+, Proteja Amazônia – employ digital infrastructures only as a tool. In this case, the area of technology constitutes a distinct department within a wider organization whose main interest is not related to issues of technology. Thus, funding is chiefly obtained by the organization, which later distributes it to the technology department, in a kind of contractual relation. And if it is the case that the developed infrastructures has its source code open/free, this is more a consequence of the developers' team working mode than the organization's initiative of contributing to the open source community.

Another important aspect of Alertas+ regards the promotion of data resilience. The system works with six different data sets, which does not render it dependent from a single source. In a scenario where the State itself promotes disinformation, to rely on a single source, such as the Space Research National Institute (INPE), would be very risky, since this institute finds itself under constant threat of

being hollowed out⁵⁸. Because of the resilience rendered viable by the availability of diverse and independent sources, Silvio states that “we will not know what goes on in *Amazônia Legal* only if the satellites fall down or something as catastrophic takes place”.

The major part of the data is automatically updated, following the periodicity of the source update. The fire spot alert published daily by the Real Time Deforestation Detection system (DETER), of INPE, for instance, is automatically verified and updated every day. The dashboard also handles data that does not need human supervision, however, they sought to set up a system less dependent on maintenance than the lines of analysis that demand numerous geoprocessing analysts to carry out the calculations. Thus, we can say that Alertas+ is semiautomatic, meaning the information update or the notification of any problems are regularly monitored, manually and automatically.

The time scale in which the dashboard operates is denominated “close to real time”. It is not possible to know what is going on in the exact moment things happen, but, depending on the source of data, it is possible to know what took place 24 hours ago, a condition that allows for society’s prompt action, Silvio says. The systems presently in use do not offer data in this time scale, which was one of the reasons for the platform seeking to fill this gap.

⁵⁸ Cf. <https://brasil.elpais.com/brasil/2021-07-13/governo-bolsonaro-enfraquece-o-inpe-e-retira-do-orgao-divulgacao-sobre-dados-de-queimadas.html>, accessed on July 21 2022.

The system works with export into open formats. Its architecture allows for the transport of components into other sites and products. This is, therefore, a structuring project, which supports plugins to import other alert systems. This feature, together with the perspective of unifying various data sets and automating maintenance to the maximum, was sought with the intention of giving the project greater sustainability, which values, Silvio stresses, a notion of open and collaborative science. Thus, every source code in the system is free/open, allowing for the reproducibility of the calculations employed, so that any organization or anyone interested can run instances of the system in order to check the calculations or to have one's own application. Furthermore, data is publicly available in API (application coding interface), ready for immediate consumption.

Final considerations

As elaborated above, the *mass self-communication* features allow for the formation of horizontal communication networks whose content is produced autonomously and have the potential to reach a considerable audience. Such factors are important elements in the development of social movements that circulate outside the traditional political sphere, giving them a space where their demands are manifested directly, without the intermediation of a representative exterior to them.

Thus, one can say that a considerable part of popular mobilizations that took place from the first decade of 2000 – the Arab Spring, Occupy Wall Street, Free Pass Movement (MPL) – employed from its origins *mass self-communication* technologies⁵⁹. Notwithstanding, after the initial furore of such mobilizations waned and we analyzing – with the sober gaze of the remaining consequences – the expectations then put into circulation, we would like to consider the following two critiques: a) despite the visibility and commotion achieved in a short period of time by such mobilizations, the related social movements found it difficult to carry out their agendas and to keep afloat for a longer time; b) the information management by the oligopoly of the big web platforms – Facebook, Instagram, Twitter, Youtube, Google etc. – have transformed the characteristics of *self-directed emission* and *self-selected reception*, which integrate the concept of *mass self-communication*.

Regarding the first point, some authors, such as Tufekci (2017) and Gladwell (2010), suggest that mass self-communication, as it allowed for social movements to form almost spontaneously, drives them apart from a more consistently formed base, where certain capacities of collective organization would have taken place:

The ability to organize without organizations, indeed, speeds things up and allows for great scale in rapid time frames. There is no need to spend six months

⁵⁹ Cf. (TUFEKCI, 2017); See also the video: “Zeynep Tufekci: How the internet has made social change easy to organize, hard to win”. Available at: <https://www.youtube.com/watch?v=Mo2Ai7ESNL8>. Accessed on July 7 2022.

putting together a single rally when a hashtag could be used to summon protesters into the streets; no need to deal with the complexities of logistics when crowdfunding and online spreadsheets can do just as well. However, the tedious work performed during the pre-internet era served other purposes as well; perhaps most importantly, it acclimatized people to the processes of collective decision making and helped create the resilience all movements need to survive and thrive in the long term. (TUFEKCI, 2017, xiii)

Thus, in order for a resistance movement to be durable and resilient against contrarian forces trying to kill it off, it is necessary to have a constant innovation capacity for action strategies. Notwithstanding, this demands more robust organicity and a sense of community than what generally is seen in movements that grow abruptly, without previous experience in community action and in collective decision making (TUFEKCI, 2017, xiii).

Furthermore, not only a more solid sense of community would suffice to favor the effectiveness of social movements articulated by means of network communication. Gladwell (2010) argues that a hierarchical structure, in which tasks and competences are distributed and coordinated among its members, is another fundamental characteristic of traditional activism lacking in post-internet movements. The horizontal structure devoid of leaders characteristic of such movements does not instigate a deeper commitment from its participants, which weakens the chances of the demands on the table being carried through to effective action: "Facebook activism

succeeds not by motivating people to make a real sacrifice but by motivating them to do the things that people do when they are not motivated enough to make a real sacrifice." (Gladwell, 2010)

Let's now consider point "b", mentioned above. Taking into account the information circulating within big web platforms - which involve social networks, search engines, news portals - the idea that the user today is autonomous to select the information he or she is interested in (self-selected reception) or to make available the content one produces to a certain audience (self-directed emission) has been shaken. As observed by Tufekci (2017, 134), from the year 2005 the internet was greatly transformed: the production of content that took place in the personal blogs and web pages came to be done mostly within great platforms, which algorithmically manipulate the visibility of information according to interests of the corporations that manage them, which for the most part are guided by commercial goals.

A paradigmatic example is the Iranian blogger Hossein Derakshan, aka Hoder:

Before 2008, he [Hoder] operated a lively blog in Farsi with a large readership in Iran, gaining a reputation as Iran's "blogfather." Tragically, he was put in jail in 2008 for six years, missing the whole shift to Facebook. When he was finally released, in 2014, he started enthusiastically blogging again - to crickets. There was no response or readership. (TUFEKCI, 2017, 133)

Hoder then started to produce and post on Facebook the content he produced before in his blog. However, his posts got lost inside the platform, since his themes were not able to earn sufficient likes to feed the algorithms that establish priority in the visualization of contents. According to him, the web became a sort of television, an observation that gives the precise dimension of the characteristics of self-selected reception and self-directed emission of mass self-communication. Even if these platform users enjoy the autonomy to seek information of interest, what he or she finds is previously filtered by search algorithms, placing them, therefore, in a condition of certain passivity. And even if the user is able to produce and post content according to his or her own interests, the reach and target audience are delimited by the platform.

Added to all this is the condition that the web platforms are mostly free, so in order to support themselves financially, they resort to advertising tactics that interfere in the privacy of their users, such as personalized advertising, which, from the collection of personal data – such as localization, age, gender, friendship circles, personal tastes, employment etc – direct their users to publicity content that is to be of interest to the user:

The only way for platforms to increase the price they are paid for ads is to create tailored ads that target particular users who are likely to buy specific products. The vast amounts of data that platforms collect about users are what allow this tailoring to be performed. These pressures to achieve huge scale and to minutely monitor users promote the

centralization and surveillance tendency of platforms like Facebook and Google and their interests in monopolizing both ad dollars and users. (TUFEKCI, 2017, 136)

Thus, today we witness a kind of hangover resulting from the initial glimpse provided by self-communication media. Tools that previously had instigated the rise up of counter-power now have turned against their users in the form of invasion of privacy, surveillance and data manipulation:

One of the deepest ironies of our current situation is that the modes of communication that enable today's authoritarians were first dreamed up to defeat them. The same technologies that were meant to level the political playing field have brought troll farms and Russian bots to corrupt our elections. The same platforms of self-expression that we thought would let us empathize with one another and build a more harmonious society have been co-opted by figures such as Milo Yiannopoulos and, for that matter, Donald Trump, to turn white supremacy into a topic of dinner-table conversation. And the same networked methods of organizing that so many thought would bring down malevolent states have not only failed to do so – think of the Arab Spring – but have instead empowered autocrats to more closely monitor protest and dissent. (TURNER, 2019, 26)

Regarding such critiques, two points should be raised. In the case studies we carried out, the adoption of a digital

infrastructure by a community takes place within a prior struggle organization. These are communities that boast a history of participation in social movements and that make use of certain digital infrastructures as a tool able to potentiate the fulfillment of their agendas. Thus, despite articulating in the context of mass self-communication, they feature the organicity and the sense of community not present in the movements critiqued by Tufekci and Gladwell.

Another point is that, apparently, the best antidote against the traps created by the big web platforms – which for many are seen as the internet itself – consists in diving deep into cyberculture's internet legacy, which involves the characteristics of a global community, of autonomy and of egalitarian and horizontal participation. This takes place in the strengthening of the open source communities, in the opening of source codes, and, consequently, in the transparency of the digital infrastructures we use. Besides, one should not diminish the fact that this legacy has reached well beyond the virtual world. This takes place when the digital infrastructure is not a mere tool but morphs with the very action mode of those using it.

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Building communities, fighting predatory infrastructures and developing open-source software

Narrira Lemos de Souza

On the 9th of September 2022, the people of the city of São Paulo, in Brazil's southeast, looked up to find the sky over their heads covered with a gray layer different from the usual pollution, as a burning smell seeped into their homes. Approximately two years ago a similar event turned day into night in the same capital city: forest fires were burning in the Pantanal⁶⁰, in 2020, and the smoke and soot took over the skies, decreased the visibility in flight routes and conjured up an apocalyptic scenario – a situation scary enough due to the then recent pandemic. However, the September 9 2022 sky is not the same⁶¹. In the end, the day did not turn into night, but the cover up of the biggest increase in deforestation of the last 15 years⁶² of the forest area of *Legal Amazônia* did take place.

⁶⁰ <https://www1.folha.uol.com.br/internacional/en/scienceandhealth/2020/10/fire-and-strong-winds-create-sandstorm-in-the-pantanal.shtml>. Accessed on November 18 2022.

⁶¹ <https://insideclimatenews.org/news/30092022/brazil-pantanal-wetland-wildfire-propaganda-bolsonaro/>. Accessed on November 18 2022.

⁶² <https://www.nytimes.com/2021/11/19/world/americas/brazil-amazon-deforestation.html>. Accessed on November 18 2022.

Without the support of the State apparatus in fighting deforestation in the region's public areas, the non-governmental organizations (NGOs) have developed projects⁶³ promoting the strengthening of the local and indigenous communities, aiming at the protection of the forest and of its defenders. The actions also aim at the promotion of security strategies for the indigenous peoples, considered by the UN as the best forest guardians in Latin America and the Caribbean⁶⁴. The need to foment parallel activities, through the mapping and georeferencing of the region and the expulsion of predatory and illegal agents for the protection of the region's forests, is carried out as a response to the sustained hollowing out of the State organizations in charge of the safekeeping of such areas. On the other hand, actions aiming at increasing the protection of the forest guardians also become a necessity, because as the state agencies decreased their support to the communities, an increase in violence was noted in the last few years, an surge of 48% of violent incidents against indigenous people in the *Legal Amazônia*, according to a 2021 report by Conselho Indigenista Missionário (Cimi)⁶⁵.

Besides, tools came to be developed and applied by other organizations, national or foreign, in order to collaborate with the mapping and denunciation of deforestation

⁶³ One such project is the coalition between Greenpeace, Hivos and Cuica: "Todos os olhos na Amazônia": <https://todoslosojosenaamazonia.org/pt/>. Accessed on September 9 2022.

⁶⁴ <https://www.rainforest-rescue.org/updates/10177/un-report-indigenous-people-are-the-best-forest-guardians>. Accessed on November 8 2022.

⁶⁵ <https://cimi.org.br/2022/08/relatorioviolencia2021/>. Accessed on September 9 2022.

activity in the region, as is the case of the *RainForest* application, which has been used in the training of indigenous people in the Amazon region, especially in the State of Roraima. Training and joint formulation of the needs and of the use of equipment in the communities are fundamental aspects for the projects' success: they are communities that know the forests, who monitor them in real time and who are able to share the needs specific for the protection of the region. The use of many tools still demand breaking a few barriers: lack of access to the internet, learning about the use of technologies, a critical gaze over what such tools can offer and the understanding of what their limits are.

Thus, in this research we tried to converse with a few of the projects that work and/or have worked with such aims in mind among Brazilian indigenous communities in the regions of *Legal Amazônia*, Cerrado and Atlantic Rain Forest. In our collective conversations, we invited people from the Hermes, Mapa Guarani Digital, Alertas+, Baobáxia and Coolab projects. Although we also did try contact with Fuxico, we did not manage to establish a communication channel with the people who maintain it, and we carried out individual conversations with Proteja Amazônia.

The Fuxico project was a proposal developed by a feminist hacker group offering communication networks linking communities by means of the *Mesh* technology, based on an open source tool called *PirateBox*, which they have adapted and used, composing their own philosophy⁶⁶

⁶⁶ <https://www.marialab.org/fuxico/>. Accessed on October 27 2022.

regarding software use and license. In the same sense, Baobáxia, of Rede Mocambos, and Coolab projects, also resort to the use of open source tools to create, adapt and provide communication networks to communities. On the other hand, Hermes is an open hardware and software technology for the conversion of radio signal into internet signal, thus promoting the possibility of connection to the internet with little financial resources and by adapting tools that the communities already have at hand.

Other groups and projects bearing a perspective of closer action with communities in mapping, georeferencing, denunciations and recording of deforestation activities and other attacks, were also contacted in the research. These are Guarani Digital Map, developed by the Conselho de Trabalho Indigenista (CTI)⁶⁷; Alertas+, developed by Instituto Socioambiental (ISA); and Projeta Amazônia, developed by the Proteja collective.

In this essay, I strive to demonstrate (1) the relations between the communities of users and of developers of free and open-source software - F/OSS; (2) the implementation and the impact of what we will call here predatory infrastructures; and (3) the paths of failure and success in the development of open source digital infrastructures that seek alliance with forest defenders. In order to do so, I investigate the concepts of open source, communities, digital and predatory infrastructures, as well as study cases and excerpts from collective talks in the

⁶⁷ <https://trabalhoindigenista.org.br/home/>.

“community calls” carried out with the groups, or of individual interviews with those maintaining such projects.

It starts on the internet

It was a sunny afternoon in Alter do Chão, a district of the municipality of Santarém, in the State of Pará, Brazil, where the river Tapajós flows. After spending the morning talking with the defenders of the lands and of the territory about the dangers they face, we reflected on how effective digital security could be for bodies threatened by firearms. This is a common question when one works with technology and the defenders of the land and of the territory, an aspect to which we should always be attentive and alert to as educators, since the line that separates safety from paranoia is tenuous and present.

In this savage effort to let go of colonized knowledge, we sought various non-oppressive learning technologies and we found in listening an essential process for learning, the “making with” as a radical technology for liberating learning (hooks, 1994). Radical because primarily it rests on the process of unveiling the world of oppression, committed to practice and to its transformation; and also because it aims to transform the oppressive reality of the apprentices in the process of liberation. Bearing in mind that the liberation process is not static, but a constant search instead.

There are various names for the learning and teaching methodology – we could speak of participating

ethnography, of an anthropological gaze or one of contextual inquiry, with a scientific-technical support from market research, but we will stick to the “doing with” as a pedagogical perspective. This is a combination of research and learning methods, and of the construction of affections between facilitators and participants, a study that mixes anthropological ethnography, liberating education and feminist intersectionality.

Once the methodology was defined, we tackled other challenges: leaving the camp of the body and of the territory to enter the area of the digital or of the digital technologies and infrastructures. The digital sounds intangible, untouchable, whereas the territory is the ground, the ground of stability. Approaches in this scenario could be both casting a gaze on the history of such technologies and the building together of meanings through their use, through the users’ context, the understanding of such tools, thus removing the separation between the body, the territory and the digital world. People’s histories as they were faced with technologies became the tool to build processes of relational learning, through analogy.

Analogy, here, is built as a form of *similitude* – the resemblance that played a constructive role in western culture knowledge (Foucault, 1995, p. 21). In analogy two knowledges overlap:

- ◆ *Convenientia*: convenient are the things which come sufficiently close to one another to be in juxtaposition; their edges touch, their fringes intermingle, the

extremity of the one also denotes the beginning of the other. (Foucault, 1995:25).

- ◆ *Aemulatio*: emulation does not depend on approximation, it can happen at a distance, as it reproduces a resemblance without contact, a reflection, though not inert, and sometimes can even be considered rivals, "without its being possible for anyone to say which of them brought its similitude to the other." (1995:22).

In its turn, analogy, this "old concept", as wrote Foucault (1995, p.29), presents itself with the power to use the subtle resemblances of relations to create similitudes overlapping *convenientia* and *aemulatio*, and resulting in a way of creating affection, kinship. Analogy is a fundamental aspect for learning in users' communities and of the tools used, as we shall see in the course of this essay.

Analogy

That afternoon, in Alter do Chão, we started with the stories. The first question for the participants was a way to explore their understanding and use of the internet, as well as checking how the internet was actually received in that territory.

"What is the internet for you?"

In the group there were lawyers, anthropologists, funders, indigenous leaders and even a priest. The relationship with

the internet was different to each one: some were born and it was already around them, others accessed it for the first time not long ago, although already advanced in years. Some hated it, others loved it. Some had the feeling of constant surveillance from technological apparatuses, others thought this to be paranoiac, denying there is such thing. For some it is a territory in dispute, for others the dispute is already lost.

In this group, the internet was built through the meanings provided by the participants: it is a means of communication, it is a tool that brings together, but it is also a tool that drives apart. The last person to answer the question was an indigenous community leader, who declared⁶⁸:

The internet is like the shaman. He is our only defense. He treats the illnesses that our doctors can't identify, he deploys his knowledge, even at a distance, he knows everything that is going on. The internet is a tool for us to use for communication, for information and to train people in the defense of our rights, people are being killed because they fight for the defense of the territory, the defense of our rights.

This indigenous woman used her relationships, her history and culture to establish a connection with the tool put forward: she created a similitude through analogy between the internet and the shaman. By means of this relation a kinship bond that connects her learning process and the

⁶⁸ We chose to preserve the anonymity of some of the indigenous leaders who are in a situation of risk.

facilitating people was created. From her understanding of what the internet is, we could finally ask questions like: how the internet comes to the territory, what are the social, political and cultural implications and its transformations resulting from the use of this tool and what are the risks in using certain digital infrastructures.

Computers, internet and hope(lessness)

As we approach the aspects that permeate the relation between individuals and technological artifacts, especially cellphones and computers, one needs to briefly look at history in order to understand the distribution of such technologies in a sociopolitical and geographic context. In Brazil, the distribution of the internet began at the coastal states with the most public universities, and little by little crawls inland. This movement was followed by the arrival of the several physical devices for access (computers, cellphones, school tablets), and also of the ways of connection, i.e., broadband, optical fiber 2G and 5G, everything varies geographically. If in some cities 5G is the talk of the town, in others the hot topic is satellite internet. This unequal arrival drives experimentation to take place disproportionately in each community. The internet arrived in the 1990's with certain risks for some, while for others it arrived in the 2020's bringing in much more devastating risks. In order to understand that, let's briefly explore the history of computation, of the tools and of the softwares that emerged in the wake of the internet.

There are controversies, but the history we know of marketable computers (and not computational machines) harks back to the 1970's; only at the end of this decade that personal computers began to be produced in mass, the following ten years being the moment in which commercialization introduced the computer to the daily life of the Global North families. The machines before the personal computer (PC) were called mathematical machines or calculators, used to create code, codified communication in financial trade and in war relations.

This period is often identified with a process recognizably linked to wars. Technology, in this context, is considered by some authors as a masculinized culture: obsessed with the control of tools, of the techniques, and, above all, of bodies, supported by the concept of Wiener's (1989) cybernetics, "the control and communication in animal and machine".

To emphasize, as I do here, the ways in which the symbolic representation of technology is sharply gendered is not to deny that real differences do exist between women and men in relation to technology. Nor is it to imply that all men are technologically skilled or knowledgeable. Rather, as we shall see, it is the ideology of masculinity that has this intimate bond with technology. (Wajcman, 1991, p. 137)

But beyond the relation with war and with masculinity supported by the idea of control, the internet's development also struggled desiring decentralized communication and globalized distribution of access and knowledge. Still in the 1980's, while some developed

systems known as “proprietary” or “closed”, others dedicated their time to imagine other possible futures for such technologies, creating systems and ideas of process openness to all people, as is the case of Richard Stallman, creator of the GNU Project⁶⁹, in 1983, of Free Software Foundation⁷⁰ in 1985, and of the GNU license⁷¹ (general public license) in 1989, a license that is widely known as *copyleft*.

If in the United States researchers worked to develop parallel systems and to imagine a free (from market or politics) Internet, it was only in 1988 that the free net emerged as a possibility in Brazil, an effort by universities to start the distribution of this new way of connecting – which only entered the Brazilian households ten years later, in 1996. A lot was already in place when the internet began to connect the Brazilian population: proprietary source and open source, copyright and copyleft licenses, emails, search websites and discussion forums. But, it is also when the alterglobalization groups (as mentioned by Silvio Rhatto, in interview) emerge with the perspective of “another world is possible”, especially as a critique to the global neoliberal movement then in course.

It is in this context that internet activist collectives (cyberactivists) begin to form, to create online alternatives and take up the technologies as a way of stopping the neoliberal advance, informed by an anticapitalist and

⁶⁹ <https://www.gnu.org/home.en.html>.

⁷⁰ <https://www.fsf.org/>.

⁷¹ <https://www.gnu.org/licenses/gpl-3.0.en.html>.

antiglobalization logic. Although successful in the attempt to create spaces in the internet to express their opinions, today this past is seen with pessimism⁷² by some:

Twenty years on and few remain in thrall to the revolutionary potential of the Internet that has been well and truly captured by capitalism. The tech giants dominate our digital lives – Facebook, Alphabet (the parent company of Google), Amazon, Microsoft and Apple together have a combined annual revenue larger than the gross domestic product (GDP) of 90% of the world's countries (Lawrence and Laybourn-Langton, 2019). Apple is the first trillion-dollar company in history. Jeff Bezos, the founder and owner of Amazon, is the richest person in history, with his net wealth increasing by US\$400 million a day in 2018. These corporations form the largest oligopolies the world has ever seen. They are resistant to traditional forms of regulation and are largely out of reach of democratically organized political will-formation. (Fenton, 2020, p. 1055)

The popularization of the internet arrived with a flavor of emergency, without public consultation, and without foreseeing the possible needs regarding legal apparatuses and the impact on the access to information. Another important aspect was the lack of discernment about what software is, what are the differences between open and proprietary source, and what are the implications of the tools' privacy policies. And what is the data that the owners of the tools could extract from their users.

⁷² In the essay *Technology, Communication and Power* in this collection, Bruno Rigonato Mundim approaches the idea of pessimism.

The open software communities

The open source communities grew exponentially in the years 2000, and in such communities the softwares' codes are freely made available for anyone to see, modify and distribute (Sharman *et al*, 2002), by means of the licenses chosen by the authors of such tools. The availability of access to the code is directly linked to the possibility that the users could take care of security and privacy of their own data, as well as validating if the tool really can do what it advertises and if this is being executed correctly. The growth of open source communities is directly linked to the expansion of access to the internet globally, generating more needs and production of technological artifacts.

In this text, the community is related to feeling part of something, something that produces a good feeling because of itself: safety in the midst of hostility (Bauman, 2003). Every community features a code: it can be a manner of speaking, the agreements between peers, or even interests in common. It is like watching an art performance or seeing a water bottle in an art exhibition: one needs to know the signs in order to get the message issued. It is not different in the open source software communities.

While activist movements took up technology as a way of amplifying their voices, they also faced the need to dominate technology and its tools. Silvio Rhatto told us in an interview that his experience as a developer took place

in this scenario: a starting point to learn how to use and develop tools in the DIY⁷³ logic, and create tools on demand. It is also at this moment that the movements begin to strengthen part of their members through the learning of such technologies.

Open source has always served as a vanguard for the rest of our online behavior. In the late 1990s, open source was the poster child for a hopeful vision of widespread public collaboration, then dubbed "peer production". Because open source software was starting to outpace software sold by companies, economists believed that these developers had achieved the unthinkable. As the internet floated peacefully in its embryonic state, it really did seem possible that the world might eventually be powered by the efforts of self-organized communities. (Eghbal, 2020, p. 15).

As the open source communities keep emerging, disappearing or growing, their modes of existence also vary – although the rule of accessing, modifying and distributing the source is still valid. The open-source program groups can be open or closed, have authorities and decision makers, or can make decisions through consensus only.

The term "open source" refers only to how code is distributed and consumed. It says nothing about how code is produced. "Open source" projects have nothing more in common with one another than "companies" do. All companies, by definition,

⁷³ do-it-yourself.

produce something of value that is exchanged for money, but we don't assume that every company has the same business model. (Eghbal, 2020, p. 44)

This also means that each community exists in its own way. A common perception of this period is that the communities of developers belonged to a specific gender and ethnicity: they were white men. This fact led to a discussion about diversity in technology, with the emergence of various groups seeking to bring in more women and the discussion around bias in technological development.

Thus, a major characteristic of open source and its communities: availability of access does not necessarily mean accessibility.

Open source is complicated because it contains a messy mix of both technical and social norms, most of which play out in public. It is documented extensively (nearly every decision is written down somewhere) but not clearly (you have to dig through years of mailing list archives to find what you need). Its treasures are hidden amidst a tangle of brambles and thorns.

Social norms are passed down through trial and error, which means that getting something wrong runs the risk of embarrassment and mockery in front of one's peers. Developers don't contribute to open source of lack of technical ability, but rather due to fear of committing a faux pas. (Eghbal, 2020, p. 43)

How much can a person access the documentation repository of an open source software if she or he does not master the signs or codes through which the developers communicate? Which leads us to the next question: for whom is the program produced? Who is open source for?

Digital Infrastructures

The predatory

In 2004, Facebook was fun; in 2006, addictive.
Adam Alter, 2017.

As early as the year 2000, the social networks had created a new environment for the production, reproduction and sharing of information that lasts until the present moment. The Meta business has enjoyed dominance in this scenario for years, reflected on the denunciations against the manipulation of the American presidential elections in 2014⁷⁴ with the use of the Facebook tool, in the dissemination of fake news in Brazil through Whatsapp tool, also during the country's presidential elections in 2018⁷⁵, or in the sale of products and the production of influencers via Instagram. In common, besides belonging to Meta, these tools promote the fast exchange of information between users, without the need to check facts, and resort to well-known gamification techniques:

⁷⁴ <https://www.nytimes.com/2018/03/17/us/politics/cambridge-analytica-trump-campaign.html>. Accessed on September 8 2022.

⁷⁵ <https://www.theguardian.com/world/2018/oct/10/brazil-fake-news-presidential-election-whatsapp-facebook>. Accessed on September 8 2022.

reward between users by means likes, comments or reactions; or financially, through contracts and increase of relevance using paid algorithms in the platforms.

Besides being “rewards”, comments and likes are also considered social proof (Hilverda et al, 2018). Social proof is a social and psychological phenomenon that demonstrates that individuals tend to imitate other people's opinions and actions, particularly if these are people they admire or for whom they hold affection. This technique is known in the market and is deployed to create strategies to engage more users in the platforms. Information technologies, in general, use various psychosocial techniques to establish users' engagement patterns, to gain a significant database and to grow in the networks. Such techniques include: exploring emotional intelligence, rewarding users, attracting them through pop culture (such as advertising featuring the endorsement of celebrities of the target audience), or the use of social proof.

Rewarding users is also an aspect of gamification. Let's use the concept proposed by Deterding (2011) to define gamification as “the use of game elements in non-gaming contexts”. Such is the case of the game *Free Fire*, launched in 2017 and that has secured a considerable database in Brazil (2021, Macedo et al) and in other countries of the Global South. Its significant growth in such regions has a simple explanation: (1) is a free game; (2) works on any device, including simpler or old smartphones. Brazil quickly became one of its main communities, and the game used local pop celebrities to attract and keep users: singer

Anitta⁷⁶ and dj Alok⁷⁷ participated in events for the platform.

The adoption of the game Free Fire by youngsters in Brazil did not take place only in urban areas, but also in rural zones, where indigenous peoples composed part of the gamers' database. There was even an exclusive competition designed for them in 2020, the Villages' Cup (*Copa das Aldeias*)⁷⁸. If, on the one hand, the game is considered inclusive as it is easy to access it both in terms of value and of the device used, on the other hand it is noxious, due to the easy path towards addiction, possibly causing physical, emotional or financial damage to the users. There are many studies scrutinizing addiction in tools and games taking into account age, exposure to technologies and schooling level and access. But I will not deal with those here. My aim is to explore addiction to certain technologies in indigenous communities, and the development of non-invasive or non-predatory technologies for these very communities.

During a visit to a Guarani village, in southern Brazil, the region's youngsters commented on their experience with digital platforms with which they interacted, particularly *Facebook* and *Free Fire*. Both were identified as noxious, addictive and negatively impacting daily lives. A youngster

⁷⁶ (Portuguese) <https://www.cnnbrasil.com.br/entretenimento/anitta-chega-ao-free-fire-intencao-e-promover-mulheres-nos-jogos-on-line/>. Accessed on September 8 2022.

⁷⁷ (Portuguese) <https://www.uol.com.br/start/ultimas-noticias/2020/05/02/free-fire-alok-faz-apresentacao-especial-dentro-do-jogo.htm>. Accessed on September 8 2022.

⁷⁸ (Portuguese) <https://tecnoblog.net/especiais/free-fire-nas-aldeias-como-um-torneio-inclui-indigenas-no-cenario-gamer/>. Accessed on September 8 2022.

related how the game made her spend a considerable amount of money in the hope of reaching a better level in the dispute⁷⁹. Others remarked how Meta's social platform took their time and attention, distracting them from the obligations and the villages' cultural life. In this perspective, such digital technologies, with closed source, centered on the experience of consumption, will be treated here as predatory infrastructures.

But the non-humans also capture humans, seducing them and/or predating them, in order to equally transform them into members of their community. Predation is, thus, intimately associated with this cosmic desire of producing kinship. (Fausto, 2002, p. 14)

Predatory infrastructures are non-human social artifacts, which, although devoid of agency because technology is neither good nor bad (Alter, 2017), are produced by other humans with the intent of capturing the users' attention on the platform. In order to do so, many tools are used and countless tests, sometimes known as "usability trials", when the designers identify what are the colors, designs, formats, texts that most attract people, and from there they are able to build a seductive tool, ready for predation. There is no empathetic intention behind that, the market of digital infrastructure production wants consumers (users) and their data, the more data the better.

⁷⁹ Márcia Nóbrega and Luciana Ferreira wrote about this at: *From the anthropophagization of code to narrative hacking: how to weave communities?*, in this collection.

"If it is free, then you are the product"⁸⁰.

Here's the question: is anthropophagy necessarily a cannibal practice or can one eat human beings as if they were mere food? If, as we saw, there are moments in which certain animals are consumed as enemies (that is, in the condition of people), it is legitimate to ask if there are moments when humans are consumed as simply food (that is, as an object-inert, support for other relations). (Fausto, 2002, p. 27)

Although there are tools in which humans are distinguished only as bits to be consumed by the tool – thus ceasing to contain one's identity, one's *ethos* and one's own existence, becoming food for the tool; on the other hand, there are technologies that are created as support for the same humans, and, as they do not use of the tools as mere market seducers, they face challenges regarding the formation of community and adherence to its proposal.

The gift

(...) we Yanomami do not keep the objects that we make or receive, even if it leaves us impoverished. We soon offer them to those who ask for them. So they rapidly move far away from our hands to constantly pass from one person to another. This is why we do not truly possess any goods of our own. When we acquire a new machete from the white peo-

⁸⁰ <https://techhq.com/2018/04/facebook-if-something-is-free-you-are-the-product/>. Accessed on September 8 2022.

ple, we always end up leaving it to a guest during a reahu feast soon after. We tell him: "I am an inhabitant of the forest, I do not want to own a lot of merchandise. Take this old piece of metal which comes to us from Omama. I have already used it enough. I will not refuse it to you. Take it back to your home. You will clear a new garden with it. Then you too will give it to someone else. Speak of me to the one who will receive it and to his kin. I want to be regarded with friendship far from my home. Later it will be my turn to ask you for something." Once this guest has returned home, he will soon give away that machete to other visitors. Then little by little it will reach unknown people in a distant forest. (*The Falling Sky*, Davi Kopenawa, 2013, p. 332).

The gift is a universal action, even the leaders of nations carry gifts. This is the sense of the *Tapiri* (...) the idea is not to deceive, it is to establish a relation. If him (the indigenous individual) goes and takes the gift, he is accepting it. If he takes it and leaves a gift, so much the better, there is a good relation. And there is he who takes the *tapiri* and breaks it, this is the best, this is the one I like best (Sidney Possuelo, in a lecture, 21th April of 2022)

In the book *The Falling Sky* (2013), the shaman Davi Kopenawa and the researcher Bruce Albert write about the path of the gift, which travels very far from hand to hand, becoming an object that generates affection wherever it goes, and something that can be retributed in the future. On the other hand, Sidney Possuelo, indigenist of the National Indigenous Foundation (*Fundação Nacional do Índio*), commented on the gift as an action to generate

proximity, to generate a relation with the other, and specifically in the context of isolated indigenous peoples: there are those who may accept the gift, those who accept it and retribute the gesture, those who do not accept it and those who not only refuse it as they break the gift, showing there is no desire in the relation proposed.

The path of the gift I want to propose here is something similar: gifts are given to somebody or to some community in order to build relations, and can result in exchanges between the people involved, or in the break of such relations. In this way, the open source softwares that we deal with can be seen as gifts: virtual objects (created by a developer or by a group of people) that are offered to users (the indigenous communities). There is no explicit request for a retribution, but there is an expected minimum, the use of such tools, a reciprocity without which there will be no relation, without which the digital infrastructure will not take place.

Some groups like the Coletivo Proteja, developers of the application *Proteja Amazônia*⁸¹, created an app and went to the user communities to check out if this product could be used, if there was a sense to it. Thus, the opportunity of verifying if the technology is going to be taken up or not and carry out changes according to the community's needs.

⁸¹ According to interview with developer Rodolfo Avelino, *Proteja Amazônia* is not available in a public repository because the code is not yet ready, but it is made available to groups they know and who would like to replicate or adapt the code.

The softwares we researched in this study are grounded on the premise of access to technology, of distribution between the communities and activism for the protection of the forests and the communities themselves. They are developed and distributed as f/oss free software and/or open source softwares, although having already understood that accessing the product does not necessarily means accessibility. There is also a controversy regarding development: there are softwares that amount to adaptations, possible within the free software ecosystem, but if the maintainers cease to support the base code, the very same software will cease to exist. Also there are softwares that have been out-of-date for a long time, and there are others that make the code available for whoever wants to use it, adapt or recreate it, but that leave no platform open to any developer, like Github⁸².

Among the projects developing open source softwares, not all of them enjoy update maintenance and/or available, as in the table below:

Name	F/OSS	Available	Starting date	Last update	Link to project
Proteja Amazônia	Yes	No	2018	N/A	No
Hermes - Rizhomatica	Yes	Yes	2012	August 26 2022	https://github.com/rizhomatica
Alertas+	Yes	Yes	2021	January 6 2022	https://gitlab.com/socioambiental/alertas-backend

⁸² <https://github.com/>. Accessed on October 17 2022.

Mapa Guarani Digital	Yes	Yes	2016	July 23 2019	https://github.com/hacklabr/mapaguarani
Baobáxia	Yes	Yes	N/A	January 13 2019	https://github.com/RedeMocambos/baobaxia
Coolab	Yes	Yes	N/A	Februar y 25 2022	https://gitlab.com/coletivo-coolab

Last check in September 2022.

The projects that aim at the creation of communication networks between the communities – even if they are not necessarily connected to the internet – aim at the promotion of access to local cultural protection and the creation of modified versions of specific open source free digital infrastructures. One example is Nhandeflix, a platform developed with the Guarani communities and supported by the Intervozes and Coolab organizations to make available content produced by the communities themselves, encouraging not only exchanges between them, but also generating autonomy regarding the modes of accessing and producing content on the internet.

In each village we set up an intranet that can be accessed via wi-fi and outside of the internet, where content by the Guarani Nhandereki is available and managed by the community. Nhandeflix is a success in the villages' intranet and it, as the time restriction can be modified in each village remotely, an important detail since there are more than 20 villages scattered in an area stretching from the municipality of São Paulo to the seaside (text by Intervozes and Comitê Interaldeias, received by personal message, on 30th of July 2022).

Among the projects actively working towards the construction of local intranet networks with the indigenous or riverside communities, there are open source softwares that stand out among those used to build such networks. Softwares we can consider as radical infrastructure due to their promotion of access and of the local production of internet content between communities. They are the *LibreMesh* and *Openwrt* softwares.

The possibility of maintenance to support free software is a vital element that popped up in the community calls of this research: funding is needed for maintenance, but it is above all necessary for the building of communities – between users, developers and funders – so that the sustainability of the project is possible.

Project	Link	Latest update
<i>LibreMesh</i>	https://github.com/libremesh/lime-packages	April 23 2022.
<i>Openwrt</i>	https://git.openwrt.org/?p=openwrt/openwrt.git;a=summary	September 9 2022.
<i>Piratebox</i>	https://piratebox.cc	Official site informs the project's closing date in 2019.

Last check in September 2022.

On the list above we made a link available for the repositories of the software used as radical infrastructures for the production of content in the communities and their latest updates. Before finishing writing this text, we added *Piratebox*, a software used by the Coletivo Marialab for the production of the Fuxico ⁸³, in order to stress that when a software ceases to be maintained, several others can cease to exist with it.

The developer

There is no formula for response; precisely, to respond is not merely to react with a fixed calculus proper to machines, logic, and – most Western philosophy has insisted – animals. (Sharing Suffering, Donna Haraway)

During this research, we carried out individual and collective conversations with developers and maintainers of the projects above, when we were able to identify similar characteristics and challenges, promoting exchanges between groups and glimpsing at possibilities for alliances. According to an interview with Silvio Rhatto, the projects can be developed by means of a team that is part of the organization, as is the case with Alertas+, or with outsourced staff who have no direct link with the organization, as is the case with the Guarani Digital Map. There is still a third possibility: developers who had direct contact with the community and decided to meet their

⁸³ <https://www.marialab.org/fuxico/>. Accessed on September 9 2022.

demands, as it's the case with *Proteja Amazônia* and of Hermes.

Each one of these situations brings in particular challenges, especially because none secures the establishment of a community of developers - something that, according to Silvio Rhatto, only takes place with big digital infrastructures, such as Linux's Kernel. A common challenge among those hiring outsourced services is the lack of funding for software maintenance, especially if the maintainer is an organization working in the territory, i.e., it is not a specialized organization in the development of technologies.

The lack of funding seems to be a generalized problem among the project maintainers, to secure both its creation, usually in competition with predatory technologies, and its existence.

It was on July 17. We stayed up there for ten days, it was supposed to be fourteen. But in this moment, this moment was very important to us, because it was the first step in this trusting relationship with them, we stayed two days in a meeting with them, we couldn't even leave the room they got for us before securing the approval of the whole village for us to walk around and also talk to the leaders in order to test the application, our idea was that they could check the interface, see if they would use it intuitively, it was more a usability trial. (Rodolfo Avelino, developer of the project *Proteja Amazônia*, in a interview, 2021).

Funding not only provides financial resources for developers, but also allows visits to the communities in order to present and test the tool developed (this cost is usually high in the Amazon region): fundamental phases to discover the needs relative to development.

And the response... We installed the application in the leaders' cellphone and then we realized that everything we had thought was ideal for them was not working, they were not able to navigate. Then they said: ah, the best is Whatsapp, everybody uses Whatsapp here, so if it resembles Whatsapp, it will work. And change we did, what were five screens in the original application became just one. (Idem).

On the other hand, if the development is the organization's initiative, it is still a challenge to communicate the need of knowing and presenting the tools to the users. Silvio says⁸⁴ that in ten years working with the development of products in an organization, not once did he had the opportunity to get in touch with the communities to whom he developed products. Something that was fundamental, also, during the development of the Guarani Digital Map, which although it was not technologically taken up by the users, they took it up in terms of content. The Guarani Digital Map is a tool that offers the possibility of recording events in the demarcated indigenous regions, those under process of reclaiming, or the old regions, by means of entering coordinates into the system. Without deploying the tools, users write the coordinates on a piece of paper, recording the data necessary for the entry in the tool, and pass them

⁸⁴ In interview: *Free software, Sustainability and Social Movements*.

on to the coordinators and maintainers of the project, who then feed the platform.

Building kinship

We realized that the creation of **relations** lies at the heart of a free software project that seeks to endure: be it to have a **community** of users, of developers, or to manage **funding** for its **sustainability** in the long run, thus securing its maintenance. But even so, all of these words in bold present challenges to those involved.

To begin with, the relation is established by means of gifts, or of names or of other possible artifacts. But the exchange, as we noticed, depends on an affinity between the actors. In the scenario of the softwares' projects that seek alliance with the forest guardians, usually this relation is not invented, but is established by means of a network of relations between other peers, and often grounded on the presentation of a problem to be tackled, as is the case with the creation of the Hermes⁸⁵ project:

Hermes first appeared over a decade ago (...) We talked a lot to professor Mauro Almeida, of IFCH, and he had participated in the creation of the High Juruá extractivist reservation. And in this project they carried out with the extractivists they always said that one of the problems they had there was communication. And in the case of the extractivists

⁸⁵ Read more about Hermes in Bruno Mundim's article *Technology, Communication and Power*.

they wrote up a letter with their demands, and one of these demands was a radio, radiophony, communication (Rafael Diniz, quote from a private conversation)

This story is repeated in the project creators with whom we talked to: they all start from a specific need of a community. In the case of the Guarani we visited, for instance, although certain technologies had been adopted grounded on an idea of inclusion (of youngsters into technological games), little by little they were perceived as noxious as they drove the youngsters away from the community's activities, as with the Free Fire game. Others, like instantaneous messaging platforms or social networks, if on the one hand they can be seen as *addictive*, on the other they allowed villages to be in contact with one another and exchange chants between them, some already forgotten by some, as a way to redeem a memory erased by the geographic distance between them. Thus, such technologies were reimaged and others could be built by means of alliances between the projects and the **communities**, as is the case of Nhandeflix:

Tekoa is a Guarani word for village, *teko* means way of life, and *tekoa* the place of the mode of life. The internet is a tool that facilitates communication between villages and helps in the political incidence on a world that is not indigenous, but it is also a tool through which the non-indigenous world de-structures the Nhandereko, a word referring to the Guarani way of life. With non-stop attention-capturing mechanisms and devices that restrict human connections to mere de-corporified

interactions, the internet has a brutal impact on the life of us all and above all on those who live in a community. Capturing the attention to a place outside of the *tekoa* dismantles the *teko*, corroding community relations. The Guarani quickly understood that they needed to build a relationship with the internet where it does not become the place where one spends most of the time, something the indigenous peoples do not understand or do not take seriously. The *Comitê Interaldeias*, the regional organization of the Guarani people, together with Intervozes and Coolab are developing tools to help in the construction of this technological autonomy. (Text by *Intervozes* and *Comitê Interaldeias*, received via personal message, on July 30 2022).

If there is a relationship between developers and users built into a community, the next challenge involves practical aspects of the third sector, especially funding, to generate two states of life that can amount to a blocking point for so many projects: **maintenance** and **sustainability**. **Funding** is a primordial aspect so that the softwares do not need to capture users' data as exchange currency: making the user become the product. It is through the funding that the software continues to be just a software – a means to access information, a mode of production of content or a means to articulate denunciations.

It is also a way of positioning funders within the commitment to social change and the protection of the forests: how is it possible for funders to promote the maintenance and sustainability of softwares that are

fundamental for the communities already so affected by the relations of technological encounters? What are the responsibilities of the philanthropic foundations in the maintenance of technological inequalities, or, above all, what are their responsibilities in the dismantling of such inequalities?

Instead of closing such issues stating that it is necessary to drive additional funding into such communities (of users and developers) this research opens up a bigger problem: how to establish far-reaching relations between these three actors (funders, developers/organizations, communities) so that jointly they are able to work for the maintenance of their desires for the protection of the forests, against climate crisis?

As Haraway would say "our debt is only just opening up to the speculative reconstruction of the world and thus to possible, material, affective, practical worlds in the detailed and concrete situation of the here, in this research tradition, not everywhere and all the time" (Haraway, 2011, p. 59), thus a deeper and speculative alliance must be created, through the deep listening of the challenges facing the forest and the digital infrastructures communities.

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