The techno-political fabric of Rio de Janeiro: insights from electricity infrastructure

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Over the last ten years, Andreia[1] – a favela resident in the South Zone of Rio de Janeiro – has started paying for electricity after many years of having a broken meter. She was previously using a direct connection to the grid, a *gambiarra*, as were most of the residents at that time. When the private electricity company, Light, implemented an electricity regularization project in the favela in 2009,[2] new smart meters were installed that were equipped with what was relatively new technology at that time. While residents generally experienced smart metering as an imposed technological choice, in the public arena, it was presented as being necessary for modernizing the city's electricity grid and promoted as a technology able to reduce large commercial losses effectively.[3]

With the media generally framing these commercial losses as a burden for both providers and consumers,[4] the technological features of smart metering embedded the promise of reducing such losses. One of the main affordances of this technology is to enable technical operations to be conducted remotely and more accurately from Light's headquarters, including meter readings, disconnections, and reconnections. Digitalizing these operations facilitated the calculation and operationalization of these tasks, improving the monitoring of electricity consumption (and fraud). The smart metering system is one of the latest technological developments to be introduced in Rio de Janeiro's electricity system, thus embedding circulating global ideas of a modern city. However, I argue that it also materializes aspirations for controlling how the city is produced.

This article considers these more recent electricity infrastructural changes in favelas, as well as their historical roots, to explore how electricity infrastructures contribute to the production of the city of Rio de Janeiro. The production of the city is understood here as part of the 'infrastructure turn' in urban studies and related disciplines (Venkatesan et al., 2018), which is used to consider the role of urban infrastructure in mediating everyday life, in giving material form to cities and in governing them (McFarlane; Rutherford, 2008). The article utilizes this field of studies – presented in the next section – to bring a new pers-

pective to the urban fabric of Rio de Janeiro, and takes electricity infrastructural change in favelas as its starting point.

Far from only affecting these spaces, infrastructural changes in favelas reveal how difference is governed in the city and works to shape the city itself, both materially and symbolically. Favelas in Rio de Janeiro have historically been constructed as "urban margins",[5] a discursive and political category that places them on the "margin of the state",[6] and characterizes them as a 'public problem' within the city (Machado da Silva, 2002). Their historical discriminatory treatment as spaces that need to be 'evicted', or 'pacified', or 'integrated' – to reference some of the public policy paradigms used to date – should be considered within the larger city project. Interventions in urban infrastructures also need to be considered within broader urban dynamics that reveal *how* urban infrastructures are used to re-order places and subjects (seen as consumers/customers/citizens) in line with the material and symbolic production of the city.

This article is based on fieldwork conducted over different periods between 2009 and 2020, during which I ethnographically explored electricity infrastructure interventions and their aftermath in different favelas in the Southern zone – the wealthiest areas of the city – and in which the electricity provider opted to regularize electricity access following a 'pacification' project, part of a public security policy developed in 2008 by the state of Rio de Janeiro that entailed the occupation of selected favelas by UPPs – Pacifying Police Units. In the next section, the conceptual framework is presented within discussions on the political role of urban infrastructures. The article then sets out three ways electricity infrastructures contribute to the urban fabric of Rio de Janeiro through the processes of 1) the reordering of the urban space, 2) urban fragmentation, and 3) everyday practices.

The techno-political fabric of cities

Within the so-called 'infrastructural turn', conceptualizations of urban infrastructures offer a distinctive perspective through which to explore and understand cities. Here infrastructures emerge as "socio-technical assemblages of materiality, discursive, fiscal, and organizational forms and relations" (Von Schnitzler, 2016), through which the city is seen as an "enormous artifact" in which the social and technical are heterogeneously engineered by a range of competing actors and institutions" (Coutard; Guy, 2007, p.717). Networked infrastructures (e.g. water, electricity, etc.) have been perceived as crucial for understanding the city's fabric. They have been conceptualized as key systems for urban modernity, urban cohesion, or urban fragmentation, based on the so-called 'modern infrastructural ideal' (Graham; Marvin, 2001). This ideal – grounded in the technological trajectories of the Global North – builds on the promise of a reorganization (and integration) of the urban space through a monopolistic, integrated, and standardized provision of networked infrastructures

throughout the entire city, while their absence has been considered a source of urban fragmentation (Graham; Marvin, 2001).

This opened up an important avenue for discussion in which the city was viewed as an artifact shaped by the changing configurations of actors, institutions, and technologies and their spatial implications. However, this proved to have certain limitations when applied to the specific infrastructural trajectories of cities of the South where, in most cases, this ideal never materialized (Kooy; Bakker, 2008) and/or where structural inequalities, colonial histories, and different forms of appropriations also shape such an ideal.

The notion of techno-politics is particularly useful for examining these specific urban infrastructural trajectories. Following on from the work of Mitchell and Gabrielle Hercht, this notion has recently undergone an important revival in urban studies. Foley et al. (2020, p.324) have defined *urban* techno-politics as "the combination of physical artifacts or other man-made objects that exist within the geo-political borders of the city and are constituted through arrangements of power and authority that embody or enact political goals". They consider that problems, definitions, and visions of the future of the city are embedded in the 'action of infrastructuring' and in the characteristics of infrastructure. This definition is especially helpful here because it can be used to consider the spatial dimension of such technological projects in governing cities and, specifically, explore the role of materiality.

From this perspective, infrastructures "reveal forms of political rationality that underlie technological projects and which give rise to "an apparatus of governmentality" (Larkin, 2013, p.328). Winner, through his famous question – *Do artifacts have politics?* (Winner, 1986) – argues that political ideas and power relations can become embedded in technological artifacts. This argument also raises the question of *where* politics is. It supports the idea of a displacement of politics from traditional arenas to technological innovations (Nahuis & van Lente, 2008). Within the possible different visions of technology, I adopt a mid-range perspective.

From an urban technologies perspective situated mid-way between technological optimism and technological alarmism, it is possible to see "the ambivalence of all technologies, the significant potential of contestation of, and resistance, to technology-supported forms of discrimination, and the deeply contingent nature of the process of appropriation of new technologies and, as a consequence, of the social "effects" of technologies." (Coutard; Guy, 2007, p.713). With this specific theoretical framework, the production of the city is here understood through its material and technological aspects, symbolic discourse, and everyday practices. The material and technological aspects of urban infrastructures give form to the city and also support and convey symbolic visions of the city (as modern, as fragmented, etc.), while everyday practices often reveal the limitations and forms of adaptation and contestation to infrastructural change.

Techno-political reordering to produce a 'safe and integrated city'

> "They [Light] want the chip with them. The meter is with them. I can use it here [at my house]. It will run, I know it will. They don't come to your door to measure anything. This raises doubts in my mind. I don't know how much light I am using. I don't know how much my meter is consuming. How is the meter measuring? We don't know. We can't really say... but if your meter is in the cabinet over there…then you can say: Gosh, my meter is consuming a lot. I'm using it a lot." (Andreia, 1º.2.2020)

In her statement, Andreia complains that meters are no longer installed on the external walls of houses but in closed cabinets in the street that only the providers' agents can officially access. According to the company, this provides an added layer of protection against attempts to hijack the system beyond the digitalization of the system itself. Although this technology was not installed only in favelas, at the time, these protective measures were aligned with other security measures introduced in the favelas to produce the image of a 'safe city'. The now well-known installation of Unidades de Policia Pacificadoras – involving a permanent police presence in many favelas since 2008 – sought to create a type of monopoly on violence in favelas by building on a shifting war to pacification narrative (Pereira Leite, 2012). It also created the conditions for expanding various urban capitals ('*capitais urbanos*') (Marques, 2016) while producing a hybrid order that favored a neoliberal urbanization process characterized by spatial arrangements that legitimized "pro-market values as the basis of social and institutional practices" (De Queiroz Ribeiro; Dos Santos Junior, 2020, p.3).

Within these broader reordering processes, the installation of this smart metering technology substantiated a new socio-technical arrangement in which extending market logic to electricity access should also have fostered an image of favelas as being less risky market spaces for investors and market actors. The interaction between the material re-ordering of 'illegal behaviors' and the production of the urban space is firstly visible in its symbolic dimension. Within a broader symbolic construction of the favelas as a specific category (Valladares, 2005), illegal connections historically convey conflicting interpretations of the favelas.

Interpreting informality as a form of resistance emphasizes the social function of these practices yet also mirrors the limited capacity (and willingness) of the state to provide decent basic urban services. At the same time, traditional media criminalized these illegal connection practices while homogenizing visions of people and places (G1, 2015). Consequently, regularizing electricity access has a symbolic dimension. This is materialized in objects and technologies that became central to implementing and understanding the political meaning of these re-ordering measures. As mentioned above, the smart metering system was a central instrument in this process.

Water and electricity meters are considered particularly powerful devices for understanding how techno-politics work in cities of the Global South, especially pre-paid meters (Anand, 2020; Baptista, 2015; Von Schnitzler, 2016) and, to a lesser extent, post-paid digital meters (Guma, 2019; Pilo', 2021). They can be considered mediating devices whose technology shapes how consumers and providers interact, how resource consumption and behaviors are measured and controlled, and how power relations are shaped. The physical distance from the meters, coupled with automatic disconnections and protective anti-fraud measures, provides a new way of reframing consumers' relationships with both the electricity provider and the source of consumption (electricity) itself. A relationship that is less mediated by human relations (the provider's agents) and technological interaction (accessing the meter).

The preventive component of this technology is also used to anticipate the risks of new (illegal) connections, reflecting the idea that favela residents are suspicious subjects (Silva, 2021). Thus, smart metering embeds the promise of a security device that commercially and materially protects infrastructure within uncertain markets and spaces (Pilo', 2021). While technology can be more clearly considered an instrument that helps create 'new territorial regimes' (Pereira Leite, 2015), another object - the electricity bill – also forms part of these re--ordering processes, but under slightly different logics.

In Brazilian society, the electricity bill – and other utility bills – not only substantiates the customer-provider relationship but is also widely used as proof of address for everyday administrative activities (opening a bank account, looking for a job, registering for training, etc.). It can be considered a hybrid document that materializes both state and market logic while simultaneously being particularly 'urban' as it has the indirect function of locating someone in the city. This hybridity also partially formed part of neoliberal discourse around 'citizenship', at least at the first stage of these projects, which supported a convergence between 'pacification' and 'electricity regularization' (Pilo', 2020). While one of the objectives of creating the UPPs was to "*devolver à população local a paz e a tranquilidade públicas necessárias ao exercício da cidadania plena que garanta o desenvolvimento tanto social quanto econômico*", in the same vein, Light framed the act of becoming a customer as a step towards 'gaining citizenship'. The term "citizenship" (*cidadania*) is used in Light's discourse by blurring the lines between customer-consumer-citizen.

> Light considers that the guarantee of citizenship is only possible with the joint efforts of the private sector, electric energy distributors and public bodies (Light, 2011).
>
> And the transformation of these areas into formal neighborhoods where residents receive an electricity bill encompasses much more than paying the bill and being able to call 0800 saying that there is no electricity; it is much more than that, it is full citizenship.[8]

This normative framing of citizenship through public-private partnerships is not specific to Rio de Janeiro and echoes global neoliberal trends of building 'citizenship projects' (De Koning et al., 2015). It is discursively justified by the severely unequal access to rights and amenities in favelas while building on the promise that becoming a customer or regularizing their situation would provide people with renewed (consumer) rights, and integrate the 'divided city' (World Bank, 2012). These discursive aspects particularly aim to create acceptance for a process that has already failed in the past.

As explained in more detail below, electricity regularization measures are not new; they have been around since the 1990s but have previously had limited results. Thus, meters and bills are also not objects newly introduced with these recent measures. However, the context considerably changes their use and meaning. As with other technical/administrative objects and procedures in the city (Cardoso; Hirata, 2017), their association with security measures and more general market-oriented urban developments make them critical objects in this re-ordering of both space and citizen-state-market relationships. This techno-political process also builds on the promise of shaping urban fragmentation.

Fragmenting the city along/through the electricity grid

The period before the new meters were installed is often viewed by residents in terms of Light's (dis)continuous presence. In some cases, such as in the favela Vila do Mar where there were only 73 residents previously registered as customers compared to 1,600 after regularization,[9] Light's presence was frequently framed in terms of 'absence'.

> "Before, Light did not pay attention to the community. Light neglected us. They only came for emergencies and we had to make do. Light brought in the electricity and installed the meters, but never did maintenance and never came here. Imagine that for decades! When a person had a problem with the meter, we would call and they would ask us to make a direct connection to the grid because they refused to come here. This is because there was no [financial] return for them. Before, there was a meter, but it was made of tin. When it rained, and to prevent it catching fire, I had to take it out [the meter]…and then we started to use illegal connections [*gatos*]." (President of the Residents' Association, 3.10.2010)

The mutual deterioration of the electricity grid and the relationship with Light is unsurprising, and the commercial aspect highlighted by the residents' association president is particularly linked to the privatization reforms of this public service that were introduced in the 1990s. Alongside the promise of better service quality and cost-effectiveness in market-driven infrastructure, privatization of the electricity sector often entailed the concession of electricity distribution to private companies. In Rio de Janeiro, the French company EDF (Électricité de France) became the main shareholder in 1997, pledging to resolve deficit issues and reduce 'commercial losses'. Electricity regularization measures

subsequently became the norm in all concession areas. A specific program – the Pronai – Program for the 'Normalization of Irregular Settlements' (Filgueiras Sauerbronn, 2001) was developed for favelas between 1999 and 2002, and was the first to introduce the idea of 'regularizing' illegal connections. This program marked a clear shift in favelas' electricity interventions.

The previous major program that residents remember was the 'social electrification program' developed at the end of the 1970s when Light was still a public company, and which officially connected most of the favelas to the public grid (Light, 1987). Whereas favelas have historically been characterized by their supposed illegality and reluctantly tolerated by public authorities (Soares Gonçalves, 2010), their electrification marked an important milestone in their de facto recognition in the city. The electrification program made it possible to separate land/housing ownership and the installation of a public urban service for the first time (interview with Renato Vasconcellos, Responsável do departamento de eletrificação 1979-1992, 21.9.2011). Before this program, due to the land tenure situation of the favelas, installing networks on land considered to be occupied without the supposed owner's permission was considered illegal (Vasconcellos, 1984). Thus, the electrification program uncoupled the consumption relationship from the property relationship, enabling favelas to be officially integrated into the public electricity grid. Whereas the Pronai objective was to turn low-income consumers into solvable customers within market-oriented reforms, the 'social electrification program' included an important political dimension. In residents' minds, electricity service quality improvements have become merged with this more symbolic dimension, materializing in individual meters and bills. This is embodied by Jose Luiz, who has lived in Vila do Mar for the past 53 years:

> "The electrification process was very important because before, there was a current of light down there, with the cabin attendants, and the light was weak. The favela was expanding, but the electricity being provided was not, so after 6 pm, the electricity went out, leaving everyone in the dark. With electrification, Light came in and it was wonderful; everyone had a meter, had an electricity bill, and was recognized. But then it started deteriorating and deteriorating and I don't know what happened, the bill didn't arrive anymore, but we paid all month." (José Luiz, Vila do Mar resident, 2011)

The gradual degradation of electricity infrastructure became visible when the shift from public electricity infrastructure to private concession intersected with a broader socio-political urban phenomenon that, since the 1990s, has seen the consolidation of armed groups in several favelas and which has largely served to merge the "problem of security" with the "problem of the favelas" (Machado da Silva; Menezes, 2019). Among other dynamics, the rise in the number of favelas taken over by gangs since the 1990s and later by the militias led to socio-political fragmentation of the urban space (Lopes de Souza, 1999), which also had consequences for urban services and infrastructure in general.

Urban infrastructures are increasingly being directly or indirectly appropriated by drug trafficking groups (Pierobon, 2021) and militias (De Araujo Silva, 2017), who use them to establish and maintain forms of territorial and social control. This leads to the construction of an illicit city in which organized crime plays a central role - within and beyond Rio de Janeiro (Müller; Weegels, 2021); a phenomenon that has been exacerbated by the Covid-19 pandemic (Petti, 2021). In this context, the appropriation of electricity infrastructure by these different powers has reinforced the spatial categorization of favelas as the locus of urban violence. Light uses a socio-technical division to separate the city into '*áreas possíveis*' (possible areas) and 'risk areas' – also called '*áreas com severas restrições a operação*' (Asro) (Castro et al., 2019) – based on the risk they are deemed to represent. According to Light, this operational categorization is primarily used to select and identify the areas in which the company struggles to reduce commercial losses because of criminal groups:

> "There are regions in Light's concession area where the concessionaire's access to its facilities is being impeded/impaired by the presence of armed groups, where there is no effective police presence" (interview with the Superintendent of Regulation, Light, 11.9.2016).

The definition of risk encompasses both commercial risk and the risk of violence, and police 'absence' is emphasized as making Light interventions more difficult. The boundaries of these socio-technical divisions have been reshaped in line with security measures. While the failure of the UPP became evident a couple of years after the first UPP was installed, over recent years, this failure has left space for a type of co-governance between police officers and gang members to emerge, which has recently been conceptualized as a 'dual security assemblage' (Richmond, 2019) many questions remain about the dynamics of such arrangements and how they may be affected by top-down policing reforms. Presenting fieldwork conducted in Tuiuti, a 'pacified' favela in Rio de Janeiro, this article proposes that 'assemblage thinking' can shed light on these issues. Despite rhetoric of reclaiming territory for the state, I argue that Tuiuti's UPP (Police Pacification Unit. This territorial aspect is embedded in a broader favela governance strategy characterized by the militarization of poor urban areas (Rocha, 2019), which is legitimized by ideas of 'crisis' and 'urgency' – as shown by the federal military intervention in Rio de Janeiro in 2018 during which tanks were used in favelas despite "the inevitability of the confrontation, death and collateral damage" (Magalhães, 2020, p.6).

This context feeds the definition and calculations of 'risk areas'. According to Light's data, in 2019, around 800,000 *customers* were living in 'risk areas' (out of 3.9 million customers, so almost 20% of the total); a figure that has increased considerably over the last few years (580,000 customers lived in risk areas in 2011 (Light, 2011)). While numbers are never neutral but linked to the way of governing (Rose, 1991), in this context, they quantify a spatial risk

and also frame unequal electricity infrastructures. This categorization is used to justify failures to reduce commercial losses and improve the quality of infrastructure as often the minimum safety conditions for repairing the network cannot be guaranteed (interview with several Light agents).

While this categorization is not new or specific to electricity infrastructures, it shows how infrastructure investment in Rio's favelas is linked to public security policies, despite the heterogeneity of individual situations where residents can access electricity. From the residents' perspective, electricity regularization and socio-technical fragmentation become a collective experience comprising strategic adaptations, socio-technical contestation, and economic insecurity.

Everyday techno-political practices

The post-regularization period has been characterized by the continuity of different collective and individual practices that illustrate the possible different linkages between the technical and the political in the everyday.

Electricity regularization obviously had different meanings for different people before these latest projects. For some residents, nothing changed: they had been customers for over 30 years and paid their bills on time. Others became customers for the first time: this was particularly true in favelas with a very low number of customers. For the vast majority, however, it meant regularizing their situation and paying (much) more than before, as it was common practice to manipulate the meters to reduce recorded consumption while continuing to receive a bill. Despite these different situations, most residents experienced the installation of the new technology (smart metering) collectively as it became the provider's preferred option for regularizing electricity in most favelas occupied by a UPP. This technology also became progressively collectively contested as bills increased over time.

New customers became increasingly distrustful of the smart metering technology. The fact that they were forbidden from accessing the meters, coupled with larger bills, raised suspicions that the company was randomly determining customers' consumption and/or the meters were faulty. The remote digital meter reading task created mistrust as its anonymity was reinforced by the hidden materiality of the meters in inaccessible cabinets. The conflicts around inexplicable high bills (Cunha; Mello, 2011; Loretti, 2016) can be partially linked to the end of a progressive payment system;[10] however, a more political explanation is that the previous meters (technically) allowed consumers to make material-technological manipulations to determine what was considered *acceptable* to pay. As smart metering limited the possibility of corruption, determining what is *acceptable to pay* – amongst other claims – partially shifted from individual/collective material practices to discussions (and contestations) in the public arena.

In one of the favelas where these meters were installed, for example, street protests were organized to demand transparency, affordable service, and effective rights (Favela 247, 2014). Here, the materiality of the bills played a role

in residents claiming their rights as they waved their electricity bills to show their dissatisfaction as consumers/customers and highlight the contradiction between being a customer (and paying the bills) and receiving better treatment – which was one of electricity regularization's promises. Thus, the technological controversies around smart meters – their correct functioning, transparency, and visibility –, combined with high electricity costs,[11] have weakened the acceptance of electricity regularization.

In addition to protests, the collective organization emerged through meetings to discuss the unexpectedly high bills. While discussions with the provider on this topic changed over time, resolving electricity-related problems became increasingly individualized. Adaptive strategies and forms of navigation (re)-emerged, but not without raising moral issues. For example, a favela resident from Flores stated he attended the association meetings to which the company was invited to explain its strategy because he was still hoping that Light would come and 'do its job' (i.e. resolve the issues), as he did not want to revert to the *gato* (irregular connection) but remain legally connected. He wanted to keep his right to claim in the event of problems but, at the same time, could not afford to continue paying inexplicably high bills.

This dilemma often emerged during discussions with residents on the importance of the electricity bill. In the period immediately following regularization, payment of the bill was afforded high priority, especially as it provided an up-to-date *comprovante de residencia* to use in everyday activities.[12] Yet, for many, electricity regularization often led to an inability to pay, prompting some residents to file a lawsuit against the company to verify the functioning of the meters. This frequently saw residents falling into debt, with some of them owing substantial amounts.[13] These legal channels often open up a new temporal window for residents, with cases taking years to pass through the justice system (Pilo', 2022). Alternatively, manipulating the meter re-emerged as a means of technically 're-negotiating' the high electricity costs. Whereas digital meters were installed in 2010 in closed cabinets that residents could not access, by 2016 and 2020, most of these cabinets were open (Figure 1) as new (counter) strategies to circumvent this technology had been developed.

Justifications for the *gato* emerge where the sense of injustice prompted by unaffordable bills intersects with economic necessity and within a changing security context that has considerably modified the affordances of this technology. While this technology embedded the promise of conducting disconnection and reconnection tasks remotely, *maintaining* the disconnection undoubtedly requires sending a (human) agent, which – according to the provider - became impossible in areas where UPP lost and gangs increased, their territorial control (interview with the Revenue Protection and Billing Superintendent, Light, 3.3.2020). Thus, the assemblage of technology, security, and sovereignty and their different configurations shaped the potential relationships and practices

linked to the electricity service. However, beyond this assemblage, there are other conditions that undoubtedly contribute to the production of electricity infrastructure in favelas. The installation of new meters, for example, can require upgrades to the system of a specific area. Carlo, for example, bought a new house in a part of the favela that is even more insecure and prepared the house for installing the meter, but Light never came. This is not an exceptional case as electricity regularization projects now tend to focus on electricity infrastructure in favelas as a type of territorial intervention, while responses to individual requests also depend on the general infrastructural conditions of that area.

Source: Pilo' (2020).

Figure 1 – Open meter cabinet.

Conclusion: understanding the city through techno-politics

This article has provided a new perspective on the production of the city of Rio de Janeiro by considering the politics of urban infrastructural change in favelas. Through the lens of electricity infrastructure, this article has examined the city's production in its material and technological forms, symbolic discourse, and

everyday practices. It has built on the notion of *urban techno-politics* to consider the linkages between artifacts, power, and space. It has shown how the material and technological aspects of urban infrastructures combine to give form to the city and convey symbolic visions of the city (as 'secure' and market-friendly, as fragmented, etc.), while the everyday (techno-political) practices often reveal forms of adaptation and contestation to infrastructural change. From an everyday perspective, the relationship with electricity infrastructure seems to be shaped by different forms of technical intervention (and non-intervention), material mediations, governance change, and uncertainties surrounding their shifting relations. More broadly, the linkages between these aspects (material, technological, symbolic, and everyday practices) provide an insight into the relationship between infrastructure and the urban dynamics that shape the city. This article has also shown how, despite these transformations, residents often feel that nothing has changed (*'nada muda'*). This most often refers to the enduring precariousness of infrastructure, as well as to the ineffectiveness of the measures developed, which support a rhythmic continuum between formal and informal access; a situation that remains a distinctive element of the urban fabric of Rio de Janeiro.

Notes

1 All names are pseudonyms.

2 A regularization program specifically aims to ban illegal connections and to regularize the commercial relationship.

3 Commercial losses are considered as the percentage of electricity consumed that is not correctly metered, billed and for which revenue is not collected.

4 Commercial losses are generally given as one of the reasons for the general increase in electricity tariffs. In fact, according to the regulation, only some of the commercial losses are integrated in the tariff, and some remain a financial loss for the provider.

5 A constructivist and relational perspective of urban margins considers them as "a situation of exclusion resulting from an official and majority representation, integrated by the dominant urban actors" (Sierra & Tadié, 2008). It deviates from the theory of marginality that has already been criticized and abandoned in Latin America since the 1970s.

6 M. Pereira Leite e C. Gomes, "Favela como margem, território da violência e território de negócios": https://wikifavelas.com.br/index.php?title=Favela_como_margem,_territ%C3%B3rio_da_viol%C3%AAncia_e_territ%C3%B3rio_de_neg%C3%B3cios

7 These discussions found their origins in Science and Technology Studies research on cities that since the 1970s have offered a valuable understanding of the interaction between urban processes and technological change by considering the effects of technology on the urban form initially, and the role of politics and cultural values in shaping urban technology, later (Aibar; Bijker, 1997).

8 Interview with Gerente de relacionamento com as comunidades, Light, 1/09/2011.

9 The number of customers before electricity regularization varied considerably from one favela to the next. For example, in another favelas of the Zouthern zone, there

were 414 customers before, and 1,017 after; in another, there were 1,045 customers before, 1,695 after, etc. In all cases, losses were over 50%.

10 A policy developed by the provider to gradually introduce consumption-related costs.

11 A large survey conducted in two favelas of the Southern zone showed that residents struggled to pay their bills after the end of the progressive payment system (Núcleo de Estudos Constitucionais, 2013).

12 For an extensive analysis of the political role of the electricity bill see Pilo' 2020.

13 For example, a resident I interviewed accumulated a debt of 14,000 reais; the minimum wage at that time was less than 1,000 reais per month.

References

AIBAR, E.; BIJKER, W. E. Constructing a City: The Cerdà Plan for the Extension of Barcelona. *Science, Technology, & Human Values*, v.22, n.1, p.3-30, 1997.

ANAND, N. Consuming Citizenship: Prepaid Meters and the Politics of Technology in Mumbai. *City & Society*, v.32, n.1, p.47-70, 2020.

BAPTISTA, I. 'We Live on Estimates': Everyday Practices of Prepaid Electricity and the Urban Condition in Maputo, Mozambique. *International Journal of Urban and Regional Research*, v.39, n.5, p.1004-19, 2015.

CARDOSO, B.; HIRATA, D. Dispositivos de inscrição e redes de ordenamento público: Uma aproximação entre a Teoria do Ator-Rede (ANT) e Foucault. *Sociologia & Antropologia*, v.7, p.77-103, 2017.

CASTRO, N. J.; MIRANDA, M.; VARDIERO, P. *Perdas não técnicas na distribuição de energia elétrica*: O caso da Light. Publit. 2019.

COUTARD, O.; GUY, S. STS and the City: Politics and Practices of Hope. *Science, Technology, & Human Values*, v.32, n.6, p.713-34, 2007.

CUNHA, N. V. D.; MELLO, M. Novos conflitos na cidade: A UPP eo processo de urbanização na favela. *DILEMAS: Revista de Estudos de Conflito e Controle Social*, v.4, n.3, p.371-401, 2011.

DE ARAUJO SILVA, M. Houses, tranquility and progress in an area de milicia. *Vibrant: Virtual Brazilian Anthropology*, v.14, n.3, 2017.

DE KONING, A.; JAFFE, R.; KOSTER, M. Citizenship agendas in and beyond the nation-state: (En)countering framings of the good citizen. *Citizenship Studies*, v.19, n.2, p.121-7, 2015.

DE QUEIROZ RIBEIRO, L. C.; DOS SANTOS JUNIOR, O. A. Neoliberalization and Mega Events: The Transition of Rio de Janeiro's Hybrid Urban Order. In: QUEIROZ RIBEIRO, L. C. de.; BIGNAMI, F. (Ed.) *The Legacy of Mega Events*: Urban Transformations and Citizenship in Rio de Janeiro. s. l.: Springer International Publishing. 2020. p.1-21.

FAVELA 247. Santa Marta protesta contra contas da Light. *Jornal Brasil 247*. 2014 Disponível em: <http://www.brasil247.com/pt/247/favela247/134579/Santa-Marta-protesta-contra-contas-da-Light.htm>.

FILGUEIRAS SAUERBRONN, F. *Responsabilidade social da Light e suas contribuições*

para a comunidade; um estudo de caso sobre o desenvolvimento humano sustentavel, Inclusão social e cidadania. FGV - Escola Brasileira de Administração Pública, 2001.

FOLEY, R. et al. From Public Engagement to Research Intervention: Analyzing Processes and Exploring Outcomes in Urban Techno-politics. *Science as Culture*, v.29, n.3, p.319-44, 2020.

G1. Furto de energia faz conta ser 17% mais cara no Rio. O roubo de energia é crime com pena de até 8 anos de prisão. Ocorrências de furto são maiores na Maré e em Rio das Pedras. Rio de Janeiro. (2015, May 26). Disponível em: <http://g1.globo.com/rio-de-janeiro/noticia/2015/05/furto-de-energia-faz-conta-ser-17-mais-cara-no-rio-aponta-pesquisa.html>.

GRAHAM, S.; MARVIN, S. *Splintering Urbanism*: Networked Infrastructures, Technological Mobilities and the Urban Condition. New York: Routledge, 2001.

GUMA, P. K. Smart urbanism? ICTs for water and electricity supply in Nairobi. *Urban Studies*, v.56, n.11, p.2333-52, 2019.

KOOY, M.; BAKKER, K. Splintered networks: The colonial and contemporary waters of Jakarta. *Geoforum*, v.39, n.6, p.1843-58, 2008.

LARKIN, B. The Politics and Poetics of Infrastructure. *Annual Review of Anthropology*, v.42, n.1, p.327-43, 2013.

LIGHT. Luz nas favelas. Uma parte da historia da Light. *Memoria Da Light*, Boletim, n.6 ano 1 novembro, 4, 1987.

LIGHT. Relatório de Sustentabilidade 2010. Light, 2011.

LOPES DE SOUZA, M. Tráfico de Drogas e Fragmentação do Tecido sociopolítico-espacial no Rio de Janeiro. In: 22º ENCONTRO ANUAL DA ANPOCS, 1999.

LORETTI, P. *Energia da crítica*: O conflito entre a Light e os moreadores da favela Santa Marta, Rio de Janeiro, en contexto de "pacificação". Rio de Janeiro: Universidade do Estado do Rio de Janeiro, 2016.

MACHADO DA SILVA, L. A. A continuidade do "Problema da Favela." In: OLIVEIRA, L. L. *Cidade*: história e desafios. São Paulo: Fundação Getulio Vargas, 2002. p.221-37.

MACHADO DA SILVA, L. A.; MENEZES, P. V. (Des)continuidades na experiência de "vida sob cerco" e na "sociabilidade violenta". *Novos Estudos - Cebrap*, v.38, n.115, p.529-51, 2019.

MAGALHÃES, A. A guerra como modo de governo em favelas do Rio de Janeiro. *Revista Brasileira de Ciências Sociais*, v.36, 2020.

MARQUES, E. Os capitais do urbano do Brasil. *Novos Estudos Cebrap*, v.35, p.11-12, 2016.

McFARLANE, C.; RUTHERFORD, J. Political Infrastructures: Governing and Experiencing the Fabric of the City. *International Journal of Urban and Regional Research*, v.32, n.2, p.363-374, 2008.

MÜLLER, F.; WEEGELS, J. ILLICITIES: City-Making and Organized Crime. *PoLAR: Political and Legal Anthropology Review*. 2021, February 20. Disponível em: <https://polarjournal.org/2021/02/10/illicities-city-making-and-organized-crime/>.

NAHUIS, R.; van LENTE, H. Where Are the Politics? Perspectives on Democracy and Technology. *Science, Technology, & Human Values*, v.33, n.5, p.559-81, 2008.

NÚCLEO DE ESTUDOS CONSTITUCIONAIS (NEC). Mutirão de atendimento e orientação jurídica aos moradores do Chapéu-Mangueira (Leme) em questões de direito á moradia e do consumidor de serviços de energia eletrica. Pontificia Universidade Catholica do Rio de Janeiro, 2013. p.34.

PEREIRA LEITE, M. Da "metáfora da guerra" ao projeto de "pacificação": Favelas e políticas de segurança pública no Rio de Janeiro. *Rev. Bras. Segur. Pública*, v.6, n.2, p.374-89, 2012.

_____. Novos regimes territoriais em favelas cariocas. In: XXVIIII SIMPÓSIO NACIONAL DE HISTÓRIA, 15. 2015. Disponível em: <http://snh2015.anpuh.org/resources/anais/39/1428368776_ARQUIVO_paperANPUH2015-Marcia-Leite.pdf>.

PETTI, D. Milícias, infraestrutura urbana e acesso à moradia em tempos de pandemia. *Coletiva*, v.11, 2021.

PIEROBON, C. Clandestine Connections: Water as the Center of Dispute. *PoLAR: Political and Legal Anthropology Review*. 2021. Disponível em: <https://polarjournal.org/2021/02/10/clandestine-connections-water-as-the-center-of-dispute/>.

PILO', F. Material Politics: Utility Documents, Claims-Making and Construction of the "Deserving Citizen" in Rio de Janeiro. *City & Society,* v.32, n.1, p.71-92, 2020

_____. The smart grid as a security device: Electricity infrastructure and urban governance in Kingston and Rio de Janeiro. *Urban Studies*, v.58, n.16, p.3265-81, 2021

_____. Security planning, citizenship, and the political temporalities of electricity infrastructure. *Urban Geography*, p.1-20, 2022

RICHMOND, M. A. "Hostages to both sides": Favela pacification as dual security assemblage. *Geoforum*, v.104, p.71-80, 2019.

ROCHA, L. de M. Militarização e democracia no Rio de Janeiro: Efeitos e legados da "pacificação" das favelas cariocas. *Revista Ensaios*, v.14, n.1, p.80-98, 2019.

ROSE, N. Governing by numbers: Figuring out democracy. *Accounting, Organizations and Society*, v.7, n.16, p.673-692, 1991.

SIERRA, A.; TADIÉ, J. La ville face à ses marges. *Autrepart*, v.45, 2008.

SILVA, I. Elemento Suspeito: Pode o favelado se identificar? Jornalismo preto e livre. 2021. Disponível em? <https://almapreta.com/sessao/quilombo/elemento-suspeito--pode-o-favelado-se-identificar?fbclid=IwAR0RlQVSng8NPcFh5vfrwoK8wr43VzSpw8uT0aTTIhkl-gte-Xd-3eS1jfk>.

SOARES GONÇALVES, R. *Les favelas de Rio de Janeiro* — Histoire et droit—XIXe et XXe siècles. Paris: L'Harmattan, 2010.

VALLADARES, L. do P. *A invenção da favela*: Do mito de origem a favela.com. São Paulo: Editora FGV, 2005.

VASCONCELLOS, R. *Luz nas favelas.* p.268-308, 1984.

VENKATESAN, S. et al.. Attention to infrastructure offers a welcome reconfiguration of anthropological approaches to the political. *Critique of Anthropology*, v.38, n.1, p.3-52, 2018.

VON SCHNITZLER, A. *Democracy's Infrastructure*: Techno-Politics and Protest after Apartheid. Princeton University Press, 2016.

WINNER, L. Do artefacts have politics? In: *The whale and the reactor*: A search for limits in an age of high technology. University of Chicago Press, 1986. p.19-39.

WORLD BANK. *Bringing the State Back into the favelas of Rio de Janeiro*: Understanding Changes in Community Life after the UPP Pacification Process. 2012. Disponível em: <https://openknowledge.worldbank.org/handle/10986/13230>.

ABSTRACT – Taking infrastructural changes in *favelas* as a starting point, this article investigates how the electricity infrastructure contributes to understanding the production of the city of Rio de Janeiro. It builds on the "infrastructural turnaround" in urban studies, and on the notion of techno-politics to bring a new perspective to the role of urban infrastructures in mediating everyday life, in shaping the form of the city – both materially and symbolically – and in managing differences and urban inequalities. In particular, the article sets out three different ways by which electricity infrastructures contribute to the urban fabric of Rio de Janeiro: 1) the reordering of urban space; 2) urban fragmentation; and 3) everyday practices. Through this analysis, the article seeks to investigate the relationship between infrastructure and urban fabric by considering the technological, material, and symbolic aspects of infrastructures that shape space and everyday practices.

KEYWORDS: Techno-politics, Urban fabric, Electricity infrastructure, Favelas, Rio de Janeiro.

RESUMO – Tomando a mudança infraestrutural nas favelas como ponto de partida, este artigo investiga como a infraestrutura elétrica contribui para o entendimento da produção da cidade do Rio de Janeiro. Baseia-se na "virada infraestrutural" nos estudos urbanos e na noção de tecnopolítica para trazer uma nova perspectiva para o papel das infraestruturas urbanas na mediação da vida cotidiana, na formação da forma da cidade – tanto material quanto simbolicamente – e na gestão da diferença e das desigualdades urbanas. Em particular, o artigo expõe três formas diferentes pelas quais as infraestruturas elétricas contribuem para a produção o tecido urbano do Rio de Janeiro: 1) reordenamento do espaço urbano; 2) fragmentação urbana; e 3) práticas cotidianas. Por meio dessa análise, o artigo busca investigar a relação entre infraestrutura e tecido urbano, considerando os aspectos tecnológicos, materiais e simbólicos das infraestruturas que configuram o espaço e as práticas cotidianas.

PALAVRAS-CHAVES: Tecnopolítica, Tecido urbano, Infraestrutura elétrica, Favelas, Rio de Janeiro.

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