Informal settlement upgrading and the rise of renting in São Paulo, Brazil

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Abstract
Rental housing was historically a minimal feature of urban informality. Now it is surging amid municipal attempts to "upgrade" informal settlements. Drawing upon a mixed-methodological study of two favelas in São Paulo, we conduct a comparative analysis of how different types of upgrading interventions shape informal rental housing at urban, community, block, and parcel levels. We find that informal rental increases precarity in urban livability and is an integral dimension of upgrading, not just a residual aftereffect. Understanding rental through ongoing cycles of redevelopment can help planners revise policymaking to accommodate emerging modes of informality.

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Introduction: Urbanization, Renting and Informality

From the late nineteenth century through World War II renting was the norm for working class populations in the Global North as well as in Latin America. Workers were largely accommodated in private-sector built inner-city tenements (Mayne, 2017), and in the case of towns and cities like Manchester in the UK, in small and shoddily built row-housing adjacent to industrial and other workplaces (Wyke et al., 2018). Across Latin America many of these inner-city tenements were viewed as slums (*tugurios*), although here, too, some factories constructed row housing for their workers, called *vilas operárias* in the Brazilian context (Sampaio, 2007). After the War, public policy stepped in with urban renewal programs in Europe and the United States, frequently replacing deteriorating parts of the city with housing projects, many that provided affordable rental rates (Vale, 2000). Rising incomes and the promotion of ownership, fueled by banks and building society loans, also led to rapid suburbanization, as lower middle and middle classes fled the inner cities (Hall, 2014).

In the 1950s and 1960s, import substituting industrialization (ISI) strategies led to massive in-migration to global South cities. Unlike in the global North, however, nascent public housing agencies lacked the resources to generate formal housing projects to scale, and it was left to the private sector to promote and generate housing opportunities informally through various modes of land development at the urban periphery (Bonduki, 1998; Rolnik, 2007). Informality, "a logic through which differential spatial value is produced and managed" is the primary mode of urbanization through which low-income settlers occupied their un-serviced lots and began the process of building their own homes through processes of self-help (Roy, 2009: 233; AlSayyad and Roy, 2003). Starting with shacks, families gradually expanded
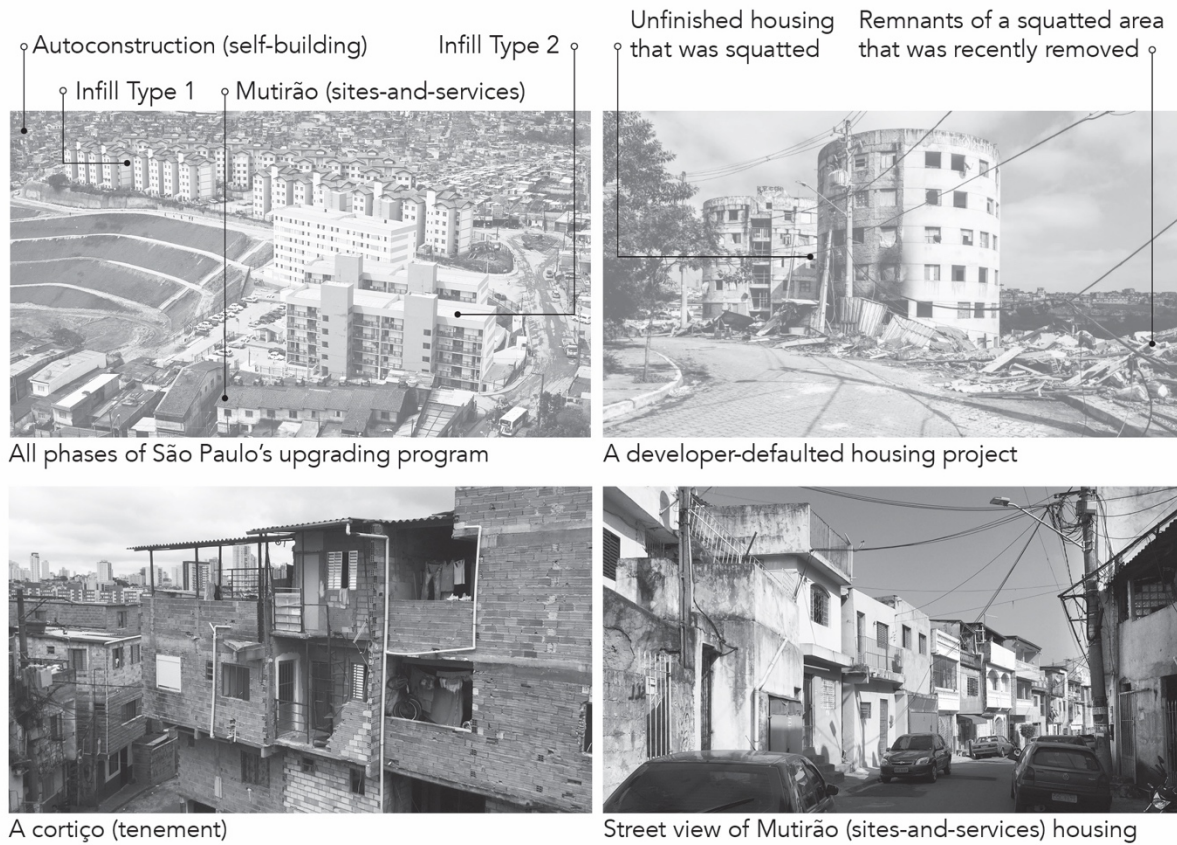
and consolidated their dwellings while also lobbying local authorities to install basic infrastructure (Gilbert and Ward, 1985).

Governments across the global South – many of them authoritarian – initially viewed these settlements as slums to be eradicated (Ward, 2012a). Beginning in the mid-1950s governments selectively evicted and rehoused people from settlements in highly visible downtown locations (Perlman, 1976; Portes, 1979). However, by the late 1960s scholars were arguing that these emerging neighborhoods were not pathological enclaves of poverty, but evidence of social capital (Portes, 1972).[1] By the late 1970s, these arguments led to policies and a type of urban redevelopment called 'upgrading' that municipalities used to integrate informal settlements into the city through a range of infrastructural and housing improvements.

The key point here is that in Latin America, post-war urbanization and rapid housing production were largely informal, privately-promoted, and reversed the previous dominance of renting to that of ownership (Bonduki, 1998; Antequera et al. 2020). As we will explore below, it is only in recent decades with globalization and economic liberalization that a rise in renting and landlordism is beginning to invert these early patterns (Baqai and Ward, 2020), especially in inner-ring area settlements formed between the 1960s and 1980s. These neighborhoods are now often heavily deteriorated – even though many have been subject to extensive upgrading projects and processes (Ward, Jiménez and Di Virgilio, 2015).

As can be seen in Figure 1, there is a wide range of approaches that fall within what is considered upgrading, or *urbanização*, in Brazil and that have shaped the urban landscape.[2] Specifically, the image in the upper left shows all four of São Paulo's upgrading approaches in a single slide: informal autoconstruction that has consolidated and has basic infrastructure; sites-and-services 'core' housing[3] built in the 1980s and 1990s; medium rise formal Cingapura - Prover[4] housing of the 1990s and early 2000s; and the most recent Urbanization of *favelas* program (2006–11), which had an initial focus on civic technologies, yet was also characterized by project abandonment and building deterioration (Figure 1, top right).[5] The image to the bottom right shows a 2017 street view of how residents have extended the parcels of an early sites-and-services development to three and four stories. Finally, to the lower left is an image of the most recent addition to upgraded communities, the very dense *cortiço*, or rental tenement house, taken from the sixth floor of a neighboring cortiço in 2017.[6]

The diversity of conditions that arise from the practice of upgrading emphasizes what Janice Perlman noted in (2010), namely that cycles of land and housing redevelopment paradoxically *accelerate informality* in ways that are largely under researched and poorly understood.[7] In Brazil, as elsewhere, these broader trends have generated local patterns of informal densification that are raising renting levels both relatively and in absolute terms (Gilbert, 2016), especially in upgraded areas (Stiphany, 2019c). In this paper our primary research question addresses this observed rise in renting, and asks, first, how have upgrading interventions in São Paulo acted as catalysts to increase renting in informal settlements; and second, how do outcomes at parcel (lot) and building (dwelling) scales vary spatially across these areas? Our goal is to offer communities and policy makers an improved and multi-scalar understanding of how upgrading's evolutionary trajectory creates rental housing submarkets and types that can be sensitively incorporated within larger scale programs of urban revitalization and housing renovation.

Labels: Autoconstruction (self-building), Infill Type 1, Mutirão (sites-and-services), Infill Type 2, Unfinished housing that was squatted, Remnants of a squatted area that was recently removed

All phases of São Paulo's upgrading program

A developer-defaulted housing project

A cortiço (tenement)

Street view of Mutirão (sites-and-services) housing

Images Top left: Fábio Knoll for the Municipality of São Paulo; top right: Mary Lima; Bottom: Author redacted

Figure 1 The range of housing conditions in intensively upgraded informal settlements.

Upgrading in Theory and Practice: Infrastructure, Revitalization, Renting

Upgrading is an urban development strategy that international agencies promote and governments adopt to progressively introduce infrastructure, regularize land titles, and build social housing in informal settlements (Andrade, Bonduki, Rossetto,1993; Walker, 2015; Caldeira, 2017).[8] Through ongoing redevelopment cycles, upgraded places become a type of informal settlement with street paving, electricity, piped water and sewerage interventions, as well as dwelling types that range from informally-produced to those that have undergone "capital-intensive demolition and replacement by high rise low-income housing blocks" that are constructed on infill sites within the redeveloped neighborhood (Huchzermeyer, 2004:10).

Upgrading's early focus on "emergency infrastructural interventions" led planners and policy makers to view it as a singular project. Basic infrastructural elements were interwoven around informal dwellings that people had constructed themselves for their families. What Brazilian planners commonly refer to as 'punctual' projects were mostly ad hoc and often disassociated from broader environmental and social issues of informal urbanization (Denaldi, 2003; Denaldi, 2016: 5). It later became clear that these small triage projects were insufficient for responding to the ways these neighborhoods were changing both internally and relative to rapid urban growth (Werlin, 1999). With persistent urbanization, upgrading expanded to encompass more capital intensive revitalization projects that displaced and resettled

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residents to social housing that was constructed elsewhere (Meth, Buthelezi, and Rajaskkhar, 2019; 1069). Some cities attempted to keep residents in places that were being redeveloped, and planners used 'roll-over' strategies that progressively resettled people from highly degraded zones, such as areas subject to extreme flooding, to new social housing in the same neighborhood (Meth, 2013). However, much of the anticipated resettlement housing failed to materialize, and de facto, reflected an "opening up of favelas to upgrading and private investment in a process of accumulation by dispossession" (Freeman, 2012; Flyvbjerg and Stewart, 2012; Gaffney, 2010).

In Brazil, and in response to growing concerns about upgrading's drawbacks, in 2001 the government passed legislation called the Statute of the City to guarantee residents participation in urban development, specifically within land-use planning areas that were called Zones of Special Social Interest (ZEIS) (Fernandes, 1993; Fernandes, 2007; Rolnik, 2011).[9] The ZEIS are coincident with the boundaries of informal settlements, and they introduce formal regulation through a wide variety of upgrading projects that are implemented within a single spatial zone. Inside of a ZEIS, people who are displaced from an area with high levels of deterioration or exposure to flooding – referred to as an 'area of risk' – are entitled to a new housing arrangement, ideally within social housing constructed in that same area (Coelho and Pascarelli, 2011).[10] Beginning in 2005, and to increase the precision and transparency of locating these areas of risk, São Paulo built a comprehensive geospatial dataset about the city's vast informal settlements (SEHAB, 2008). Municipal planners used big data to more precisely pinpoint where and how to intervene in informal settlements with a variety of projects: infrastructure and social housing, but also linear parks in formerly occupied riparian zones, and recreational campuses on remediated landfills (SEHAB, 2012; Moser, 2016).

Given the literature about interactions between early phases of upgrading and citizenship in Brazil (Holston, 2009), one may still think of this type of urban transformation in relatively modest terms. Yet this local picture may not capture how upgrading has morphed in response to ongoing spontaneous densification, and into larger-scale iterations. At the same time, citizens are increasingly subject to data-driven planning, and this has impacted how particular areas of settlements are rebuilt, and who is displaced (Stiphany, 2021). Therefore, decisions that may appear to be narrowly focused on infrastructure are an expression of the political nature of upgrading or what Roy (2009) refers to as "calculated informality": acts of planning that are intended to formalize informal areas but that exacerbate sociospatial injustice. These redevelopment injustices are generating populational flows and new categories of informality across the global South (Harris, 2018). One outcome of these flows in São Paulo is the diversification of informal rental housing. Redevelopment rental housing in São Paulo's informal settlements arises when governments depopulate sites and, rather than build enough resettlement units, they issue rental vouchers that displacees use to find their own accommodation – a strategy adapted from the U.S. Hope IV program (Stiphany, 2019c). Informal rental types and morphologies vary spatially across inner-ring and peri-urban settlements. Informal rental housing in inner-ring areas, for example, typically occupies a greater proportion of an informal dwelling than in peri-urban settings (Stiphany, 2019c). Conversely, peri-urban rental properties, owing to larger lot sizes, share similar qualities to "backyard rentals" in the African context (Turok and Borel-Saladin, 2016; Stiphany, 2019c). In order to maximize profit, some owners convert entire buildings into rental units, as shown in the example of the cortiço to the bottom left of Figure 1.

In both the global North and South there are wider concerns about increases in informal rental housing, among them the extent to which rental reflects an increase in poverty and, by increasing physical density but decreasing per-person living space, exacerbates precarious conditions (Naik, M, 2015; Wegmann, 2015). Research in the 1990s reported on rental because the poor were already facing
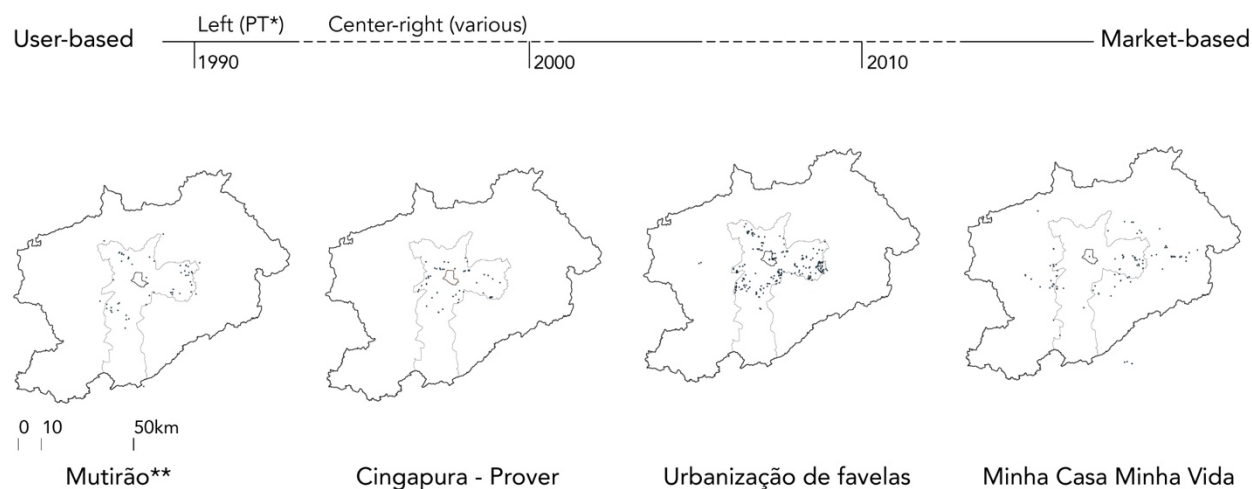
difficulties in obtaining land and become homeowners in Asian and Latin American contexts (Kumar, 1996; Edwards, 1982). As rental markets expanded, building additions pressured fragile infrastructural systems, and poor cost recovery (through tax or consumption charges) limited the potential for public sector improvements in low-income neighborhoods (Wegmann and Mawhorter, 2017; Sheba and Turok, 2020). Incremental rental conversions and additions often add up to significant benefits for landlords but create dismal conditions for renters, including poor ventilation and sanitation, hazardous access and egress (circulation) and unsafe sharing situations (Gulyani, Talukdar, Bassett, 2018). More upgrading, and by proxy more rental housing, appears to tip informal settlements from affordable neighborhoods to places where people whose livelihood is tied to the informal sector can no longer find affordable shelter.

In addition to increasing access to low-cost housing, rental markets offer benefits, including investment opportunities for homeowners, such that "many of yesterday's bridge headers are today's landlords" (Gilbert, 2001: 6). Furthermore, the adaptable nature of informal dwelling processes is conducive to creating flexible spaces that families can use for relatives or renters (Wegmann and Mawhorter, 2017; Ward, Jimenez, and Di Virgilio, 2015). Recent research in São Paulo suggests that there is a range of actors involved in rental micro-redevelopment with the result of new-build housing types, different unit and tenure mixes, and integrated community and commercial property uses (Stiphany, 2019c). The challenge is that urban research often overlooks how local social *and* material dimensions of renting relate to broader formal redevelopment processes.

Upgrading -- São Paulo Style

In fact, the right of citizens to reshape cities characterizes the theory and practice of upgrading in Brazil. As elsewhere, Brazilian upgrading was initially a mechanism for solving infrastructure problems in informal settlements. In distinction, this seemingly prosaic practice came to fruition as Brazil was transitioning out of a 20-year military dictatorship (1964 – 1984), led by democratic urban reform movement that viewed *any* urban transformation as a potential to materialize a right to the city (Arantes, Bonduki, Rossetto, 1994; Rolnik, 2011). In São Paulo and as illustrated in Figure 2, below, since the 1980s, conservative and liberal political administrations have distributed projects that have mixed infrastructure and different housing types into informal settlements across the urban periphery. Owing to a basis in a right to the city, and as revealed by our field research, the shape or size of the upgrading project carries less importance than *how* that intervention transforms the relationship between low-income neighborhoods, cities, and governance (Stiphany, 2019a). At the same time, there are clear phases of upgrading in São Paulo and as shown in Figure 1, distributional patterns that have transformed the urban landscape over a 40-year time horizon.

Viewing Figure 2 (below) from left to right shows that upgrading projects were initially channeled to settlements at the peri-urban fringes, and over time those investments shifted toward places closer to the city center. In 2009, São Paulo's trajectory radically changed course when the Federal government adopted the Minha Casa Minha Vida (MCMV) program, and divested from municipal upgrading budgets (McTarnaghan, 2015). To support MCMV, municipal authorities created new ZEIS on blank peripheral tracts to build housing of a magnitude that informal settlements could not support. MCMV has undoubtedly increased the number of housing units produced, but the location of these units has dramatically decreased access to urban services and advantages, reflecting a retreat to the rational planning paradigms from which upgrading initially departed (Stiphany and Ward, 2019).

User-based ——— Left (PT*) Center-right (various) ————————————— Market-based
1990   2000   2010

Mutirão**   Cingapura - Prover   Urbanização de favelas   Minha Casa Minha Vida

Data Instituto Brasileiro de Geografia e Estatistica, IBGE (Brazilian Institute of Geography and Statistics) Secretária de Habitação, SEHAB (São Paulo Housing Secretariat). *PT = Partido dos Trabalhadores (Workers' Party). ** Addresses for mutirão locations in São Paulo were obtained from Bonduki, N., Andrade, C. R. M., & Rossetto, R. (1993). *Arquitetura e Habitação Social em São Paulo, 1989 – 1992*. São Paulo: Secretaria de Habitação e Desenvolvimento. These addresses were geolocated and made into a shapefile.

Figure 2 São Paulo Metro Area and São Paulo Municipality showing the different phases of upgrading over time, and by different administrations (leftist PT versus more conservative parties in government).

There is one element of São Paulo's upgrading program that endured. Since 2004, the city began experimenting with the use of rental vouchers on an ad hoc basis and for people displaced from their homes by fire or other extreme events. This practice exploded in 2006, when the vouchers were issued to thousands of people displaced from hundreds of redevelopment sites around the city (SEHAB, 2012). Between 2004 and 2015, the municipality invested almost a billion reis (R$986,498,202) in informal rental housing production (City of São Paulo, n/d; Stiphany, 2019c). [11] Similarly to the MCMV program, the vouchers have primed the financialization of social housing in Brazil (Rolnik, 2019), and because the voucher value has never changed, have constrained rental production to informal settlements (-author redacted-). Therefore, municipalities are not circumventing their legal obligation to produce housing for extremely poor households, but they are designing an alternative logistics for people who were displaced from an 'area of risk' to shape housing demand and supply elsewhere in communities (Blanco, 2013; Stiphany, 2019b).

São Paulo: The Context, Scales of Analysis, and Research Methods

We focus on upgrading in São Paulo, where municipalities leveraged an economic boom to upgrade more informal settlements during the decade of the 2000s than ever before.[12] Eighty-five percent of Brazilians live in cities however deep sociospatial inequalities are a recurring challenge. Fifty-four million Brazilians (26% of the population) are extremely poor; and the 2018 national household survey foundation showed that 66% of families do not have access to proper sewerage systems (PNAD, 2018). In the municipality of São Paulo, where 12.1 million people live within a wider metropolitan area with a population of 23.4 million, an estimated 1.3 million inhabitants live in favelas with an irregular urban morphology or informal self-help subdivisions called loteamentos that are frequently developer-

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promoted, also without services but with a regular lot and block layout (IBGE, 2010). Of note, the extent of informality changes dramatically when it is counted as a function of the dwelling unit, not the household. Drawing from São Paulo's informal settlement databases HABISP and Geosampa, of the 3,574,286 total houses in the municipality of São Paulo, 30% of the total are in a favelas or loteamentos (HABISP, 2008; IBGE, 2010). Given that upgrading attempts to improve urban livability, it makes a difference how much of the urban fabric is constructed informally, and, as we show below, how much is allocated to informal rental.
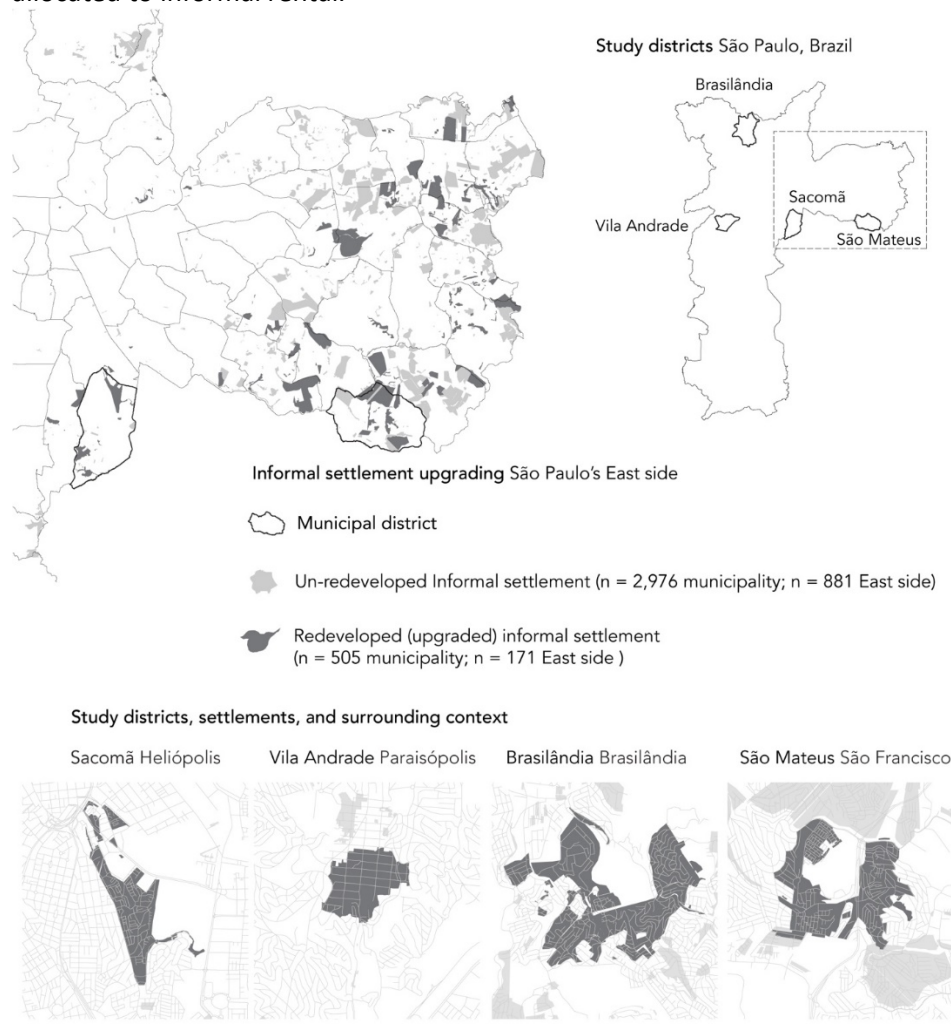
Figure 3 Informal settlements (redeveloped and un-redeveloped) and study areas in São Paulo. Note that for the purposes of this paper, São Paulo's three types of informal settlement (favelas, loteamentos, and núcleos) are identified as "informal settlement" and categorized as either redeveloped (upgraded) or un-redeveloped.

Top: The large map details the East side of the Municipality of São Paulo, its local districts and associated data relating informal settlements and redeveloped (upgraded) informal settlements.
Bottom: These diagrams contextualize the distinctiveness of the study settlement context in four districts and in relation to surrounding settlement morphology.

We evaluate how these broad trends relate to community change using multi-scalar units of analysis: 1) the municipality of São Paulo; 2) local sub-municipal districts; 3) individual settlements; 4) intra-settlement sections (*núcleos* or 'clusters') named by local residents whose boundaries they understand; 5) the block level; and 6), the micro building and household levels. As shown in Figure 3, our city-wide comparison focuses on four districts where settlements are large, upgrading has been extensive, and where the rise in rental housing appears to have significant impact. In order to focus in on the local social and physical dimensions of upgrading, we also document household scale renting in two of the districts on São Paulo's eastern side: Sacomã and São Mateus, where redevelopment programs are of a greater magnitude relative to other parts of the city. Specifically, within these districts, we analyze in detail two favelas of similar size and settlement period, Heliópolis in Sacomã; and Jardim São Francisco in São Mateus. In part, these two areas were selected because they have experienced all of the successive phases of upgrading approaches shown in the upper left of Figure 1, and outlined by time and in space in Figure 3. These two communities have also been studied through prior extensive fieldwork.

The concentration of São Paulo's upgrading projects across four main districts is illustrated in Figures 2 and 3. Two districts, Sacomã and Vila Andrade, are located equidistant (10 kilometers) from the city center in the post-industrial inner ring, with Sacomã on the low-income industrial East side, and Vila Andrade to the wealthier West side. The other two districts are located outside of the inner-ring and feature distinct urban patterns. As can be seen in Figure 3 (bottom), there are sharp morphological divisions and population densities between the settlements of Heliópolis and Paraisópolis and the surrounding district contexts in Sacomã and Vila Andrade, respectively. These physical and social divisions are reinforced by the income differential shown in Table 1: in Vila Andrade, incomes outside of Paraisópolis are among São Paulo's highest, at six times those inside the favela. By contrast, in Heliópolis the difference is less pronounced (about one-third difference between the favela and the surrounding district). Significant to these economic divisions is the fact that Paraisópolis is closed off from the surrounding Morumbi neighborhood by a concrete perimeter wall, while vital transportation infrastructure, water management systems and urban services surround Heliópolis.

There are also major differences in settlement patterns in cases at the urban margins. Morphologically, Brasilândia and São Francisco have an irregular shape that reflects how settlements form to the topography of rolling hills, valleys, and, at the center of São Francisco, a decommissioned landfill. Both of these settlements are characterized by sprawling landscapes of informally-produced housing and deteriorating infrastructure, where the division between the formal and informal city is barely visible, if at all. Population densities and income differentials exist, but as can be seen in Table 1, they are not nearly as dramatic as their inner-ring counterparts.

Despite similarities in size and settlement period, there is considerable variation in levels of upgrading across these four areas. Vila Andrade has significantly more inhabitants living in informal settlements, and yet the municipality has allocated far fewer projects to this district compared to Sacomã. Both districts have the largest informal settlements in the city, which were established during São Paulo's first significant rise of favelas in the late 1960s, but Paraisópolis was upgraded for the first time in 2006, almost twenty years after Heliópolis' first upgrading projects broke ground.

Table 1 Comparative data for informal and upgraded informal settlements, by District and by study favelas.

	São Paulo municipality	Sacomã district	Heliópolis favela	Vila Andrade district	Paraisópolis favela	Brasilândia district	Brasilândia favela	São Rafael district	São Francisco favela
Population	12,000,000	248,000	62,073****	127,000	55,336	265,000	80,474	144,000	30,903
% population living in IS*	12%	25.6%		41.1%		36.3%		42.7%	
Informal settlements	2976	38		20		119		35	
% IS upgraded	17%	50%		20%		21%		28.6%	
Population density **	80	55	434.85	39.8	561.18	63.14	233.76	32.7	147.69
Income***	5	3.13	1.7	12 (USD$2,400)	1.7 (USD$340)	1.7	1.44	1.7	1.3
% Renter	23.5%	25.6%	25.7%	21.3%	29.9%	22.4%	19.5%	17%	11.1%

Data (2010) Instituto Brasileiro de Geografia e Estatistica (IBGE). *IS = informal settlements; **Population density = number of persons per hectare; ***number of monthly salaries. Note: 1 monthly salary as of 2/2020 = BRL$1,045 or USD$200. **** Reported favela populations are likely undercounted by at least 50%.

In the remainder of this paper we focus upon the intersection of upgrading and renting. Our data and case-study materials show that in intensively upgraded settlements close to the city center, renting exists on about 50% of all parcels (lots). We also show that the increase in rental demand creates changes in the nature of informal housing and commercial-use production, and, as a result, in the character of communities. Finally, we conclude with a brief discussion of the implications for policy, planning and further research.

Measuring Rental Housing at City, Community, and Parcel Scales
We evaluate upgrading's various impacts on informal settlements with a three-phased mixed-methods data collection strategy that extends a nine-country comparative study of informal dwelling change (Ward, Jiménez, and Di Virgilio, 2014, 2014).[13] An important contribution in this paper is that we are able to compare the accuracy of census data used for geospatial analysis with qualitative and quantitative data gathered over an eight-month period of intensive fieldwork in Heliópolis and São Francisco. We analyze data trends at three scales, starting with a city-level comparative analysis of

informal settlements and upgrading (phase 1); followed by drilling down into two case-study settlements, where we used focus groups with residents, a household survey of 799 informal dwellings (phase 2); and an intensive case-study methodology to photograph, take detailed building measurements, and create 3D models of each surveyed dwelling (phase 3).

By combining these city-wide, community-level, and parcel-specific data about the impacts of upgrading, we are able to explore how the upgrading cycles described above have impacted owner occupancy and shaped the production of rental housing. We specifically focus on the most recent cycle of upgrading, comparing census data to identify the social and material changes in informal settlements prior to the implementation of the "urbanization of favelas" program (2000), through to the present. After reviewing São Paulo's most intensively upgraded areas, we narrow the focus to the two field study settlements where our 2017 study data evaluates the overall morphological change in the built environment at the block and parcel levels.

Phase One: Documenting Citywide Trends
We document upgrading locations and the relationship between the settlement and surrounding district using census data obtained from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatistica* – IBGE) and shapefiles of informal settlements provided by the City of São Paulo's Housing Secretariat via the HABISP geospatial dataset (SEHAB, 2008). This allowed us to identify the size, settlement year, and demographic features of almost 3,000 informal settlements in São Paulo, tied to the year and type of upgrading projects that have been implemented in 505 settlements.[14] For four of São Paulo's largest and most intensively upgraded informal settlements, we selected data from each census tract (2000 and 2010 census boundaries) to measure population density, income, and renter status. These data revealed the total population living in each settlement, the number of physical dwellings, the location of upgrading projects, and the existence of a geographical area of risk (see endnote 11 for a definition of what constitutes risk). We used GIS software to evaluate if upgrading projects of any type are distributed relative to municipally-defined areas of risk (Table 2).[15] We return to this analysis in the results section, below.

Table 2 Comparing the Distribution of Upgrading Projects (n) in Informal Settlements with and without Areas of Geographical Risk across Four Urban Districts

	Total (n)	Informal settlements With area of risk	Upgraded informal settlements With an area of risk
Brasilândia	119	37% (44)	5% (2)
Vila Andrade	20	40% (8)	13% (1)
Sacomã	38	16% (6)	50% (3)
São Rafael	35	11% (4)	25% (1)

Data (2010) Instituto Brasileiro de Geografia e Estatistica, IBGE (Brazilian Institute of Geography and Statistics).

Phase Two: The Meso (Mid-level) Community Study

Once we had determined where upgrading projects were located in the city, the next step was to understand how their implementation was perceived and experienced by people who live in these informal settlements. We undertook four focus groups with residents and community leaders in Heliópolis and São Francisco in order to gain insights about two elements that are argued to shape variation in the implementation of upgrading: citizen participation in project design and development; and in the management of families who were displaced from redevelopment sites. These focus groups illuminated local perspectives and the fact that planners appear to seriously overlook the "big data" that they themselves, as part of city government, had used to prioritize areas within ZEIS for upgrading, and to assess its efficacy.[16] This suggests that other political decision-making criteria were in play, not unusual in São Paulo or other Latin America cities (Baiocchi, Heller, and Silva, 2001), but nevertheless a lost opportunity to utilize the quality of the data that the municipality had amassed. Moreover, local perspectives verified an uptick in renting. It also became apparent that some of the redevelopment sites were illusory and were never constructed, leading to a resurgence of squatting, and thus new rounds of eviction displacements as shown in Figure 1 (upper-right quadrant). These two key aftereffects of redevelopment are both important since they can lead to parallel processes of densification and degradation.

Phase Three: The Micro Parcel Level Study

Our urban and community-level studies revealed four broad categories of housing types that are mixed in upgraded informal settlements, as shown in Figure 1 (upper-left quadrant). Across these four categories, we used a weighted sample to undertake a combined (one respondent per) household survey and post-occupancy evaluation of 1,032 randomly selected housing units, 799 of which were parcels on which a sites-and-services or self-help dwelling had been built (435 in Heliópolis, 364 in São Francisco), and which form the basis of our analysis here.[17]

Table 3 Comparisons in the Two of the Case Study Settlements Showing the Proportion of Parcels (Lots) with Renting, Renters, and Extent of Absentee Landlordism.

	Heliópolis (n = 435)	São Francisco (n = 364)
Rental parcels	42% (183)	15% (56)
Autoconstruction	37% (115)	19% (37)
Sites and services	53% (68)	12% (19)
Renters	25% (108)	10% (35)
Owner landlords	67% (123)	66% (37)
Absentee landlords	33% (60)	34% (19)

Data "Redacted study title." Redacted grant institution. #redacted grant number.

It is important to emphasize a note about the unit of analysis. In order to evaluate the social and physical dimensions of renting, we compare parcels in which renting is occurring versus renter respondents (Table 3 above). Our 2017 questionnaire data for a respondent who was a renter was consistent with census data (for 2010): we found that 25% of respondents were renters and un-related to the owner. Unremarkably, the 2010 IBGE data show that 26% of households in peripheral areas are

renters. Yet as Table 3 suggests, beyond the single issue of tenure (owner and renter in this case), there is a more nuanced process of dwelling and lot evolution for rental housing accommodations over time.

In addition to asking respondents detailed questions about building construction on their lot, our fieldwork data also identified renting through informal signage advertising rental opportunities, and by querying shopkeepers about commercial rentals. This additional step revealed that unbeknown to policy makers and residents, when one measures rental opportunities by building (either for residential or commercial purposes), the actual number of rentals in informal settlements is *nearly double* that of the Census' data and of our survey count by a respondent's tenure status. Thus, by taking a parcel-scale audit of renting we have revealed another important layer of missing data that implies the need for new strategies of data collection. In short, a parcel level survey and analysis of a building's volumetric (vertical) dimensions reveal a greater depth of social and physical dynamics than is revealed by household or by 2D building footprints as the singular unit of analysis.

Results

The uneven development of upgrading
Despite three decades of effort, São Paulo has sought to redevelop only 17% of informal settlements in the municipality. The outcomes are even less impressive, however, if evaluated at local levels. Spanning upgrading activity from 1980 onward, most upgrading projects are concentrated in the city's oldest and largest neighborhoods, many of which have already achieved physical consolidation and have high levels of community organization, while high (and different) social and physical vulnerabilities continue to exist in newer settlements.[18] As previously mentioned, if the proportion and absolute number of people who are living in informal settlements is considered to be a proxy for vulnerability, then vulnerability in and of itself appears not to be a driving factor for upgrading. Comparing the city's largest upgraded settlements, the bulk of upgrading is happening in the São Rafael district and in the Sacomã district, even though the majority of informal settlements and their residents live in informal settlements in Brasilándia and Vila Andrade, respectively (Table 1). This suggests that upgrading projects are being distributed to areas that are neither the city's poorest nor where the majority of the population reside in informal settlements. Rather, upgrading is likely channeled to settlements that have become embedded in collaborations or exchanges with local government.

More notable is the fact that despite the use of geospatial sensing to more precisely pinpoint areas of degradation, and thus redevelopment, settlements that concentrate upgrading projects concentration do not appear to consistently overlap with areas of risk (SEHAB, 2007). Of the 32% of informal settlements defined as having areas of risk (965), only 20% (189) have been upgraded. In Brasilândia and Vila Andrade (Table 2), 40% of settlements have risk designated areas, but only a small percentage has been upgraded. By contrast, even at the peri-urban fringes in São Rafael, only 11% of settlements have areas of risk, but 25% of these have been upgraded. In Sacomã, an even greater percentage (50%) of settlements with areas of risk have been upgraded (Table 2). This variation raises further questions as to why certain areas of the city have been consistently targeted for redevelopment, and suggests that while upgrading is clearly linked to the ZEIS, and the ZEIS to informal settlements, there is no clear indication that allocation of an upgrading project seeks to target or mitigate precarious conditions in informal settlements with high risk assessments. Instead, as we suggested earlier, this highlights the limits on what geospatial data can offer urban redevelopment, and that if 'areas of risk' are not a driving factor, then urban redevelopment is likely decided according to other, more political, criteria and calculus.

Uneven Patterns of Rental Housing Across Upgraded Settlements

What *is* being redeveloped is rental housing, which comprised the majority of change in informal housing stock during São Paulo's final phase of upgrading and after. Figure 4 shows that increases in renting between 2000 and 2010 have broadly shifted to the low-income Southwest and Eastern parts of São Paulo. While renting across São Paulo barely increased between 2000 and 2010 (22% to 23%), it *almost doubled* in peripheral regions, from 15% to 26% (IBGE, 2000, 2010). Our GIS hotspot analysis confirms that increases in renting appear to concentrate in areas of intensive upgrading, and that rental patterns also vary between inner-ring and peri-urban locations.
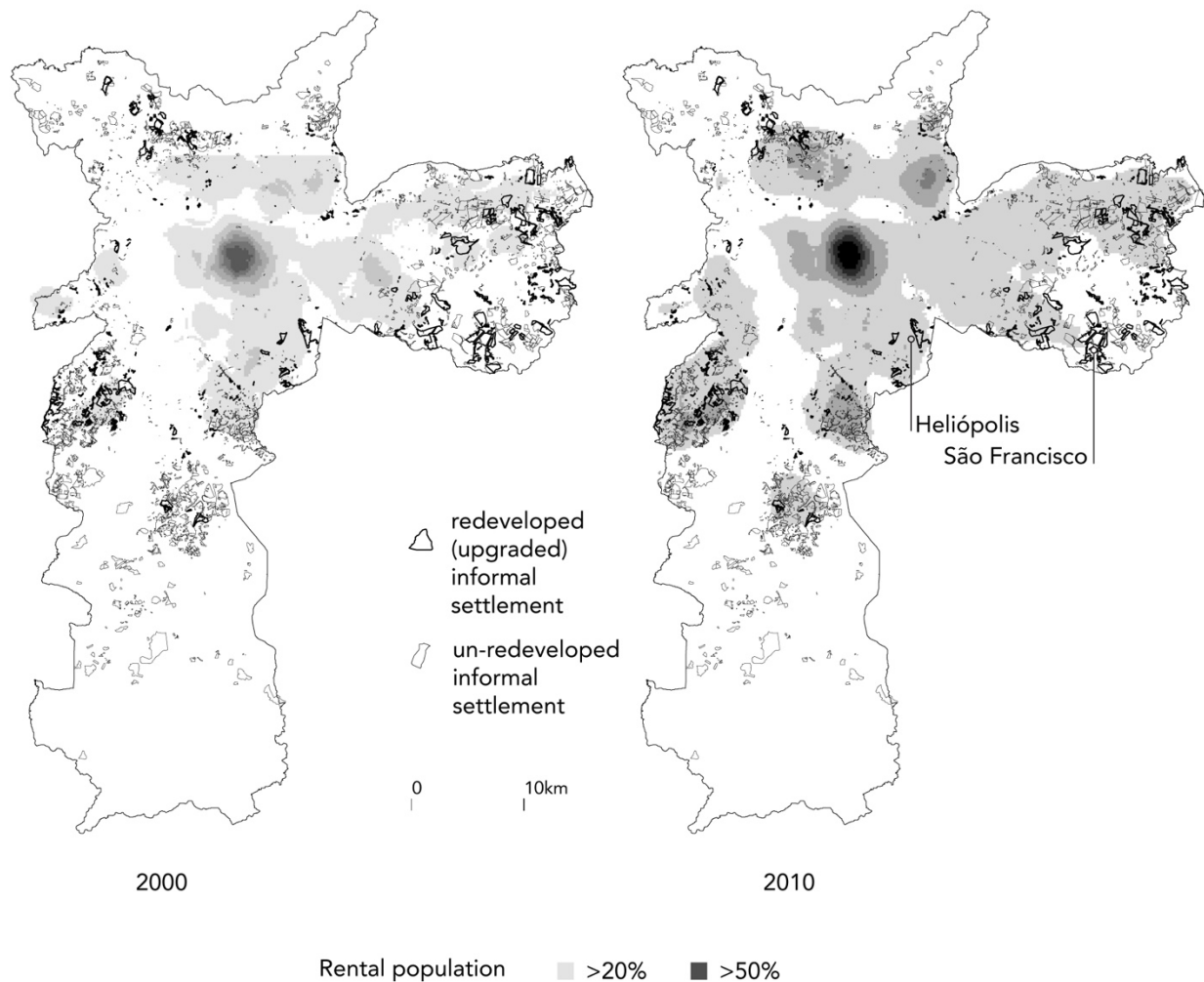

Figure 4 Mapping Rental Housing Increase and Spread Across São Paulo Municipality from 2000-2010.

Renting rose in São Francisco, but it surged in Heliópolis despite the implementation of identical upgrading program approaches, number of areas of risk, and roughly the same number of people displaced from project interventions in each. Although our data do not precisely measure how much

renting is tied to municipal vouchers, we do know that the voucher value has been fixed at R$400 since 2006, while the average rent in 2017 in Heliópolis was R$602 and R$533 in São Francisco (-Stiphany, 2019c). This suggests that the municipal-subsidized vouchers have contributed to higher rents in informal settlements, but that displaced residents are being priced out of the very places where they previously lived.
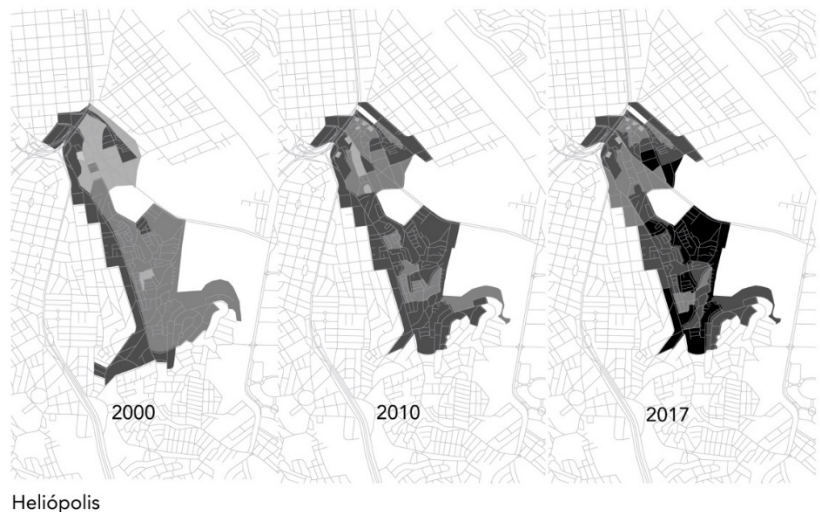
Figure 5 Mapping Three Time Horizons of Changes in Renting by Parcels for Heliópolis and São Francisco, 2000 to 2017. Top: Heliópolis showing dramatic increase in older blocks to the South and East. Bottom: São Francisco's peripheral locals reveals more modest (but significant) increases to the North and East, also in more established areas.

The Rise of Informal Rental: A Comparison of Characteristics at Community and Micro (Parcel and Household) Scales in Heliópolis and São Francisco

Having provided an overview of across the municipality, we now analyze informal patterns of renting in Heliópolis and São Francisco, and do so by combining census data with our study data to compare how rental housing varies by settlement, within settlements, and across individual parcels.

Community transformation: horizontal patterns of renting

Figure 5 clearly illustrates that rental patterns in informal settlements vary across peri-urban (São Francisco) and inner-ring locations (Heliópolis). Holding upgrading as a constant, São Francisco has significantly lower rental, as measured by respondents who are renters and the presence of rental on a parcel (Table 2). This relationship changes within the high-rental area of Heliópolis: while 25% of respondents were renters, almost half of the buildings in Heliópolis are devoted to rental occupancy in some guise or other, in full or part. Although our data cannot substantiate the extent to which this rental build-up is directly tied to upgrading, *prima facie* it does seem likely that the introduction of basic infrastructure primes informal settlement owner households to consider undertaking rent-seeking strategies. In Heliópolis, if an owner converted just one space for rental, and collected just the voucher value (R$400) per month, they would see a 20% increase over the average annual income (Table 1).
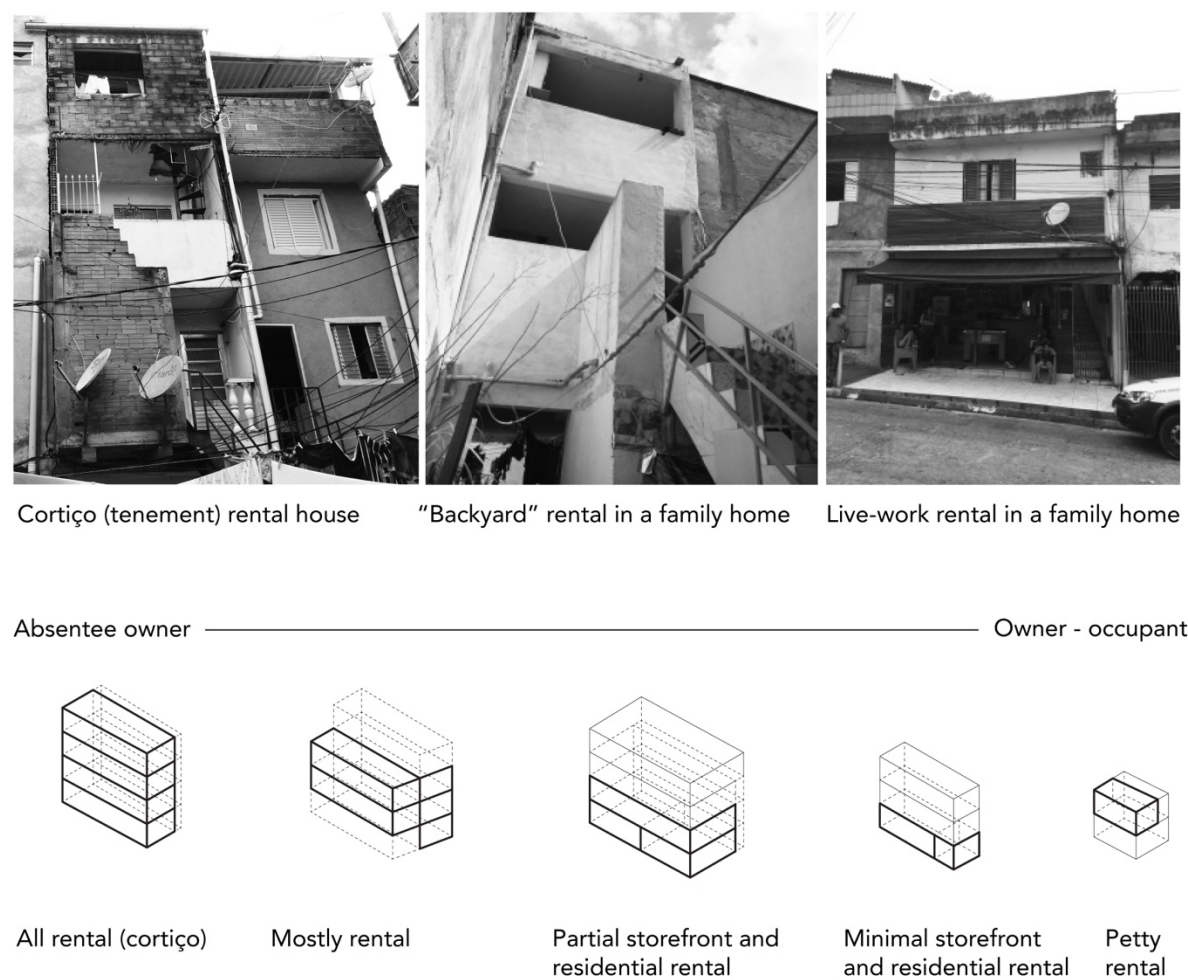
Figure 5 shows that rental housing appears to concentrate in the oldest areas (to the East) of both communities, and has dramatically increased at the block level between 2000 and 2017, especially in Heliópolis, where renting exists on a majority of parcels in some blocks. While we must emphasize that these trends fall somewhere between a cortiço (100% rental) and a family-occupied dwelling with minimal or modest renting, the map clearly indicates that major sociological, physical, and architectonic changes are underway. But what determines propensity to transition from ownership to rental? And why do sites-and- service sections of informal settlements appear to be especially attractive to such transitioning to rental opportunities? As displayed in Table 3 above, in Heliópolis 53% of sites-and-services parcels have some form of renting upon them compared to 37% in self-help (autoconstruction) parcels.

We hypothesize three likely reasons: first, original lot sizes in sites-and-services developments were somewhat larger (modal lot size = 108m^2 [6 meters, street frontage, by 18 meters lot depth]), which made them one-third to one-half larger than the typical self-help lots that did not begin with a 'core' house. Second, the engineered (graded) block provided a level lot platform, in addition to hook-ups to water, electricity, and wastewater (drainage) services that established a more secure foundation upon which to build horizontally, and especially vertically (additional floors), relative to a 6-meter by 6-(36 square meters) lot. Thus, lot size, baseline construction and basic service infrastructure embedded within sites-and-services housing make this redevelopment type particularly conducive to safe incremental expansion. Third, although self-help and sites-and-services sections of informal settlements co-evolved beginning in the 1980s, households in the latter were somewhat better off, given that residents did not have to cover the costs of initial infrastructure and a basic 'core' house. The concentration of renting on 'sites-and-services' parcels suggests that rental microdevelopers are more likely to build on larger lots with a secure footing, than building on a slope with less well-endowed services or self-built additions.

Parcel Scale Transformation: Lot and Room Conversion and Subdivision for Rental

Our data demonstrate that renting also varies considerably at the parcel level, especially in Heliópolis. Figure 6 shows five common patterns of how informal dwellings are subdivided for rent, and that

provide a sense of how different levels of renting are embedded within informal dwellings and how these relate to tenure. Moving from the diagram's left to right, the wholesale building conversion into an absentee-owner cortiço gradually diminishes into a petty and mixed renting conditions, one where renters occupy a small proportion of an owner-occupied dwelling.

Cortiço (tenement) rental house   "Backyard" rental in a family home   Live-work rental in a family home

Absentee owner ———————————————————————— Owner - occupant

All rental (cortiço)   Mostly rental   Partial storefront and residential rental   Minimal storefront and residential rental   Petty rental

Figure 6 Tenure patterns of informal renting at the parcel scale in Heliópolis.

A number of previous studies have examined how the conversion, expansion, and/or subdivision of informal dwellings is frequently motivated by ageing parents who wish to provide a home for adult children and other family members, and who plan home extensions or lot subdivisions in contrast to the ad-hoc addition of rooms for rent (Ward, 2012b; Jiménez and Camargo, 2015). However, recent research suggests that the micro-development of renting by owners and other intermediaries is

diversifying how rental is mixed into buildings and urban form, often in conjunction with commercial opportunities (-author redacted-).

Community Transformation: Vertical Patterns of Renting

Finally, we explore how rental is changing the character of these communities. Figure 6 shows that in Heliópolis, local clustering of rental properties is developing far from recent redevelopment sites at the community's northern sector, again emphasizing that there is a clear spatial disconnect between the supply and demand sides of renting. Google street view™ images from 2010 show rental's changing urban morphology, namely that even at the peak of community consolidation and municipal redevelopment activity, families maintained low-rise dwellings, rarely expanding above two stories. In comparison, a decade later and during the deepest economic decline in decades, the same streetscape has been recast: many parcels now have more than two stories, and some have been entirely re-built. Our reading is that parcel-level adaptations for rental appear to have expanded not so much during the aforementioned economic peak (up until 2010) than it has during a ten-year economic decline since that date.
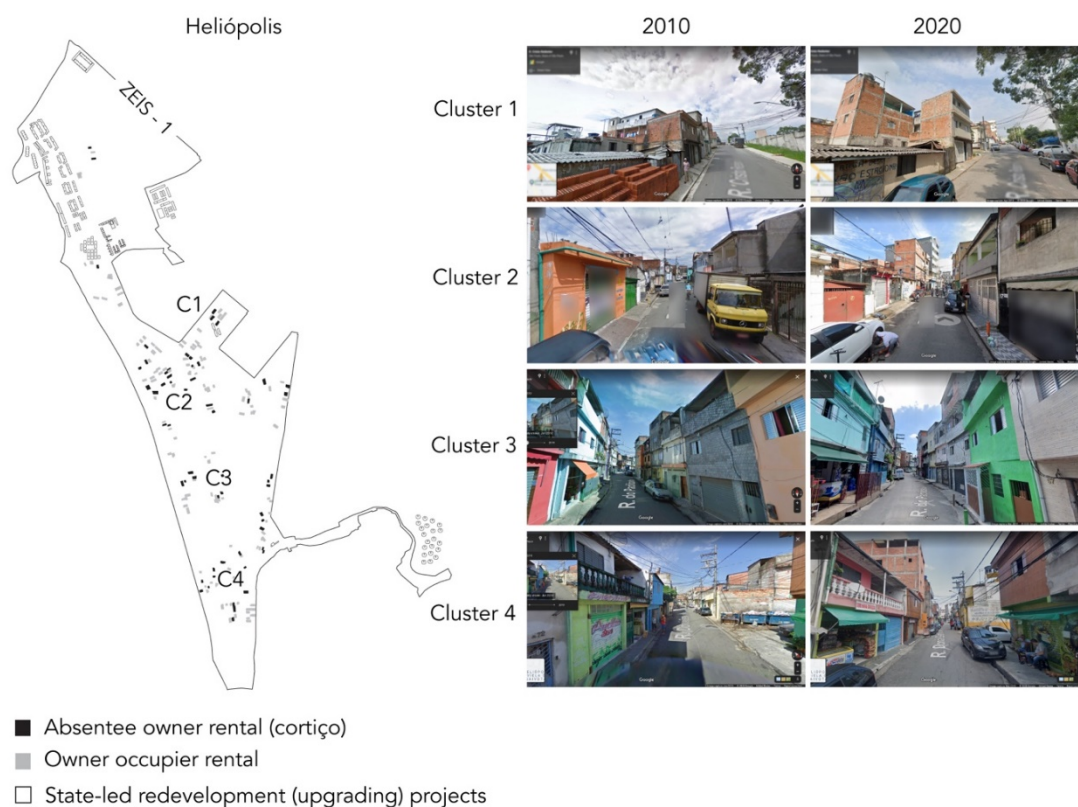
Data (2011) Secretária de Habitação, SEHAB (São Paulo Housing Secretariat); (2017) "Redacted study title." Redacted grant institution. #redacted grant number; Google Street View™.

Figure 7 Visualization of the renting data sub-set (n = 239) of the larger study, showing high rental clusters in Heliópolis, and images that show vertical expansion and small-scale commercial development between 2010 and 2020.

Concluding Discussion: What is Next for Upgrading and Rental Housing Policies in Latin America?

In this paper we have combined different scales of data to explore the impacts of long-term upgrading programs in the municipality of São Paulo. Our study shows how upgrading's various policy trajectories have intensified densification and the subdivision of dwelling space for residential and commercial rental. We have focused upon the upgraded informal settlements of Heliópolis and Jardim São Francisco, where the rise of rental housing appears to be considerably higher than in non-upgraded settlements. These dynamics suggest that informal rental is an integral mechanism of State-led upgrading processes, not a residual aftereffect.

Upgrading is a sensitive topic across the global South (Das and King, 2019), and, in some respects, São Paulo is a unique case. The municipality has adopted a number of approaches over the years that have left an indelible mark on the urban landscape. And yet spontaneous densification has persistently outmatched planned interventions, particularly in the wake of the most recent 'urbanization of favelas' program. Renting is one of the outcomes resulting from Brazil's economic decline, and the changing nature of upgrading policies in São Paulo. Broadly, rental is leading to greater precariousness in urban living standards as density increases, as new renting space is added, as environmental and economic stressors intensify, and as overcrowding leads to draw-downs in public services (water, electricity, and trash collection) that threaten human health and safety. Based on our analysis, we believe that rental can also be a powerful tool for guiding future redevelopment policy and projects.

The outcomes of upgrading in Heliopolis and Jardim São Francisco illuminate that urban transformation is not driven solely by physical change but has implications for housing highly vulnerable populations in cities. The inclusive, horizontal, and progressive nature of the Brazilian policy environment has been celebrated for informing global thinking about how to effectively and equitably intervene in particular urban neighborhoods. There is no doubt that residents of Heliopolis and Jardim São Francisco have become inequitably embedded within São Paulo's upgrading cycles (Stiphany, 2021). There are clear benefits of the rental market for landlords but associated resource streams also disproportionately impact extremely low-income households. Perhaps the idea to advance is that while the 'tipping point' of communities toward rental reproduces sociospatial inequalities, also important are situated perspectives of how working class populations are active agents of housing policy. There is unevenness in how rental has been mixed into communities, but looking at dwellings lot-by-lot reveals insights that planners can use to recalibrate the practice of redevelopment to local scales in ways that are relevant for future generations of low income urbanites.

As redevelopment and rental markets coevolve, outcomes will invariably affect not just specific redevelopment sites, but almost everyone living in an upgraded settlement. And yet apart from generalizations that renters are poorer relative to owners and are more prone to migratory 'churn', we know relatively little about who are today's renters, what is their socio-economic and household composition, and how different rental morphologies create vulnerabilities in specific cities and housing markets. This evidence gap is even more pronounced when it comes to landlords and the decision-making processes that motivate their pursuit of informal rental investments. The cortiços (tenements) have all too rarely been the focus of study (Kowarick and Ant, 1988; Sampaio, 2007), and relatively few scholars study them today (Santoro, 2016; -author redacted-), despite their role within the dynamic arena of absentee landlordism, informal rental dwelling construction, and tenancy promotions.

One area of improvement is our ability to gather better data about these local conditions, especially when undertaken in conjunction with communities (Heikkila and Harten, 2019; Stiphany, 2021). By

engaging what Williams (2020) refers to as "data action," transdisciplinary collectives are supplementing big data with local data, but they are also legitimizing the role of communities as translators of urban sociospatial change. Our local data findings indicate that outcomes are not modest conversions confined to a dwelling's back or interior spaces; rather, they are systemic and planned, reflecting the various ways that working-class populations are using their dwellings to significantly improve their livelihoods. The challenge will be to feed these local data back into communities in ways that create effective and ethical interactions between building transformation and policy. Planners must consider how mixes of rental and ownership housing arrangements may also lead to neighborhood changes and where those might displace more vulnerable populations, especially those that have already been routinely displaced over cycles of urban interventions.

Over the last two decades, a relatively small number of researchers and international organizations have advocated for low-income rental housing (Gilbert 2003; Blanco, 2013; Blanco et al., 2014). Despite sound arguments, related research and policy have gained little traction towards the creation of incentives that will protect both landlords and tenants (Baqai and Ward, 2020); address how taxation might play a role in mitigating the negative externalities of renting (Scheba and Turok, 2020); and in the São Paulo case, more directly redistribute public expenditures toward infrastructure and expanded home ownership in low-income neighborhoods (-author redacted-). As new-found voices and others argue (Blanco, 2013; Gulyani, Talukdar, Bassett, 2018; Baqai and Ward, 2020), rental housing policies should be paired with credit and micro credits to increase redevelopment's sensitivity to dynamic neighborhood investment processes, many of which continue to be informal.

Our findings here support the need and urgency for policy change in São Paulo. We argue that actions should not be embedded within redevelopment programs that plan informal settlements through areas of risk. Ending the voucher program would be unethical and, likely, ineffectual. At the same time, ignoring the intersection of upgrading and rental overlooks planning-generated injustices. It also misses the opportunity to translate real rental production and consumption possibilities into sensitive densification programs of housing renovation, adaptive reuse, and land reform (Fernandes, 2021). Moving forward, upgrading can address basic infrastructure as it always has, but may entail integrating housing morphologies that mix tenure and type into a broad framework for engaging incremental urban processes and that derive from citizen planning. Rental housing's small scale can facilitate how planners unite households with different incomes in spatial areas beyond the ZEIS and support new expressions of working-class social agency. Failing to account for the dynamics of renting will only weaken new redevelopment endeavors – as they have in the past.

* * *

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[1] Although the term "social capital" had not yet been invented, it was implicit in many of the early classic studies of inner-city residents whose homes were primed for eviction through urban regeneration zones. For example, see Michael Young and Peter Willmott, 1957, *Family and Kinship in East London*; Herbert Gans, 1962, *Urban Villagers: Group and Class in the Life of Italian American*s; and Jane Jacobs, 1961, *The Death and Life of Great American Cities.* All were classic works of the late 1950s and early '60s.

[2] As Huchzermeyer (2004) notes, the Portuguese term *urbanização* is distinct from urbanization and implies a planned material intervention in an informal settlement.

[3] 'Sites and services' is a variant of upgrading that was promoted from the 1970s onwards and comprised public acquisition of land that was subdivided into individual serviced lots, frequently with a serviced infrastructural plenum in the form of a modest 'core' house or just a kitchen and bathroom, to ensure basic infrastructural standards (Laquian, 1984). For a detailed analysis of sites-and-services projects called "mutirão" in Brazil, see Felipe, 1997. Also see Gyger, 2017, for an analysis of the Peruvian context.

[4] Coined for its genesis in a Singaporean housing model, the Cingapura (later renamed Prover) is a one-size-fits-all housing type that was designed to progressively replace autoconstructed dwellings with new multi-family infill blocks. See: Huchzermeyer, 2004; Krähenbüel,1996.

[5] In this case, the developer defaulted on the construction of a social housing project initiated in 2011, which was then re-squatted by previously removed residents, who were subsequently evicted.

[6] The term "*favela*" is well known and in the remainder of the paper we have chosen not to italicize it nor *cortiço* (tenements with an absentee landlord) or *loteamentos* (informal subdivisions).

[7] Also see Roy, 2005; 2009.

[8] The redevelopment of informal settlements is commonly referred to as "slum upgrading." Following Gilbert (2007) we no longer find the term 'slum' applicable to describe informal settlements that have consolidated and/or have been redeveloped.

[9] The Statute of the City is a participatory toolbox that planners and citizens use to make collective decisions about urban planning and management. For a detailed account of the Statute within the Brazilian planning paradigm, see Fernandes, 2007; Rolnik, 2011.

[10] The nature and level of an area of risk is determined by the municipality and the primary criteria were topographical (level of slope and perceived vulnerability to landslides), and exposure to flooding.

[11] Municipality of São Paulo. Approximately 187 million US dollars.

[12] For a detailed analysis of housing policy in Brazil in the 1960s and 1970s, see Portes, 1979; and Perlman, 1976.

[13] This methodology has also been modified in the context of Ecuador: See Peek, Hordijk and d'Auria (2018.

[14] Of the 2,976 informal settlements in São Paulo, 1025 are loteamentos, 1951 are favelas.

[15] Using GIS, we created a buffer of 100 meters around all upgrading project sites to analyze where upgrading projects exist relative to areas of risk and to informal settlements (ZEIS).

[16] The municipality's method for using GIS to identify areas of risk and prioritize settlements for upgrading is presented in SEHAB, 2007 and SEHAB, 2008.

[17] The remainder of the questionnaires (n = 233) were applied to the infill multi-family housing blocks, and to Minha Casa Minha Vida program inscribers (who are living in various situations). Those 233 questionnaires are not discussed here.

[18] See Walker and Alcarón (2018) for recent work on new informal settlements at São Paulo's peri-urban margin.