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URBAN DIVERSITY AND TRANSFORMATION:
Public housing and the 'hidden morphology of plots'

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ABSTRACT

What are the drivers of urban transformation, including microeconomic diversity and growth? And what could refrain transformation? The city of Rio de Janeiro received 218 developments of the Brazilian Public Housing Programme "Minha Casa Minha Vida" (PMCMV) in the last five years, mostly located in peripheral areas. Recurring criticism has been made to the programme in relation to size and locations of projects, along with a lack of urban diversity and infrastructure. Verifying the assumptions latent in such criticism, this paper develops a methodology to assess (1) the degree of microeconomic support that the built environment offers to residents; (2) the morphological and functional interfaces of new housing complexes and their neighbourhood; and (3) the impacts these complexes have on the economic diversity of their surroundings. In a first empirical study, social and spatial attributes of areas around twelve housing complex in areas of different levels of topological accessibility and building density were compared, including pedestrian movement, distribution of retail and services, and an index of diversity in urban activities based on Shannon's entropy. A second empirical study analyses variations in land use and land parcelling in West Rio, from 2011 to 2015. Assessing the impact of housing complexes on the microeconomic diversity, this approach identifies *divergences* between patterns of accessibility, and patterns of location of housing compounds and activities. Results indicate (i) substantial differences in topological and absolute distances to the CBD; (ii) strong influences of accessibility in the morphological and microeconomic integration between housing complexes and their neighbourhoods; and (iii) significant influence of land subdivision on the rate of change of land uses in areas of sprawl.

KEYWORDS

Diversity, microeconomy, sprawl, land subdivision.

1. INTRODUCTION

What are the drivers of urban transformation and microeconomic diversity? A long tradition in spatial economics and more recently in space syntax tell us that accessibility, assessed either as absolute or topological distances, is a key, axiomatic factor. From Von Thünen's rural economics to Hansen's (1959) "How accessibility shapes land use", Alonso's (1964) general theory of land rent, and Goffette-Nagot's (2000) "Urban spread beyond the city edge" on the one hand, and Hillier at al's (1993) "configuration and attraction in urban pedestrian movement" or Chiaradia et al's (2013) "compositional and urban form effects on residential property value patterns" on the other, we came to understand the central role of accessibility both in concrete, visible

change in three-dimensional form, and in hidden or elusive things like land values, land uses and pedestrian movement. But there might be other vectors of growth and transformation. For instance, what are the impacts of top-down decisions on new, large residential complexes? Do massive public housing compounds qualify as such vectors? On the other hand, what could refrain transformation? Economists tell us about disadvantages of agglomeration such as city size, traffic congestion, air pollution and so on. Here we could well include poor accessibility and progressive urban sprawl.

In this paper, we analyse urban phenomena that seems to fit such patterns of stimulus and hampering to transformation – namely, the effects of top-down housing decisions under certain conditions of accessibility and (topological and absolute) distance on the local diversity of activities. By looking into cases of housing complexes in areas of urban expansion in Rio, with low density and poor transportation facilities (we should say 'sprawl'), we could observe rapid local transformations in urban diversity – and found empirical traces of something previously little explored: how the 'infrastructure' of architectural morphology, namely the plots that define property and parcels of land to build, takes part in the dynamics of transformation – a potential role for the virtually invisible 'legal frame' of morphology, or what we call 'the hidden morphology of plots'.

Recent work carried within the syntactic community (Netto et al, 2012; Netto, 2017; cf. Al-Sayed & Penn, 2016) has shown that the process of *convergence of urban patterns* such as accessibility, density and land uses, mostly assumed in spatial economics and space syntax, is far from unproblematic. It is subject to processes of progressive diffusion stemming from collective action into other dimensions of the urban, taking the form of passages and mutual influences. It seems mediated by information, i.e. by how actors learn about spatial advantages in accessibility and land values. It may also be influenced by fluctuations of land values potentially dependent on micro and macro economies; by changing densities and processes of building substitution; and by changes in accessibility itself. However, these previous works have not brought to the forefront the potential role of the *'hidden morphology of plots' as a material layer mediating urban transformation*.

The idea is simple: certain plot structures (especially regarding size) may either ease or refrain change in land uses and the substitution of buildings or the densification of urban form. We use as a case in point the impacts of public housing complexes built by the gigantic federal programme "Minha Casa Minha Vida" (PMCMV) in the city of Rio de Janeiro. Between 2011 and 2015, Rio had received 218 developments from the public housing Programme "Minha Casa Minha Vida" (PMCMV). Of this total, 148 complexes or 68% are located in the western area of the city. West Rio is the most recent area of expansion, displaying low density and brownfield land along with industrial and rural activities. Its expansion began in the 1950s and was further developed in the 1990s. There is a remarkable lack of efficient infrastructure and public services, such as transport and health and education facilities.

Unsurprisingly, the construction of these complexes has generated strong critical reactions, mainly concentrated on problems with extremely large distances from Rio's Central Business district (CBD) and other job locations, and on the surroundings of housing complexes, which tend to display a poor capacity to meet the daily demands of residents, causing them to travel long distances. The typological difference of the dwellings can also be considered as an impact factor. Small plots of single-family residence of up to two floors predominate in this region. However, housing projects under the Programme "Minha Casa Minha Vida" are usually built in the form of very large gated communities with multi-storey typologies.

Verifying the assumptions latent in these critical views, this article proposes a new methodology to evaluate (i) the degree of microeconomic support that the built environment offers to local residents; (ii) the morphological and functional interfaces of new housing complexes and their neighbourhood; and (iii) the impacts that these complexes have on pedestrian movement and the microeconomic diversity of their surroundings. The approach first analyses the diversity of microeconomic activities around twelve housing complexes using an index derived from Shannon's (1948) information entropy. Secondly, social and spatial attributes of the areas around

each housing complex are compared, including pedestrian movement, retail distribution and service, and an index of activity diversity, morphological characteristics and spatial accessibility. In a third moment the research analyses the variation of land uses and the potential influence of the land parcelling in an area of expansion of the West Zone, creating a temporal analysis of microeconomic activities before and after the construction of the housing complexes. Our data indicate that the new gated communities have effects as vectors for transformation of these areas, namely toward increases of microeconomic diversity.

Assessing the impact of the complexes on the density and diversity of their surroundings, we shall see that the streets where the housing complexes are located tend to be the highest accessibility and density levels, while the streets where microeconomic activities are emerging tend to be streets with *lower* accessibility levels. This counterintuitive condition seems to imply a break in one of the axioms of spatial theories such as urban economics and space syntax alike, according to which variables like density, accessibility and activities location tend to converge. This unexpected empirical finding prompts the need for further explanations, which might reside either on *contingent* and *contextual* conditions that often elude theory, or on generalizable phenomena perhaps underestimated in classic approaches – although complexities in the relationship of street accessibility, location factors, land-use diversity and land values have been identified (e.g. Shen and Karimi, 2016; 2017). Assessing the problem inductively, our morphological analyses will suggest that *the actual structure and size of urban plots may be preventing the establishment of new activities in streets with the highest accessibility levels*, leading to biases or negative implications over potential multiplier effects generated by accessibility and microeconomic forces.

Results indicate (1) substantial differences in the performance of housing complexes regarding degrees of integration and distance to the city centre; (2) strong influence of accessibility and site layout as morphological and functional integrating factors between housing complex and neighbourhood, including evidence of negative impacts on connectivity and grid intensification, increased presence of walls, and monofunctionality; (3) potential influence of the structure of land subdivision on the rate of change of land uses in areas of potential urban growth.

2. SUPPORT FROM THE NEIGHBOURHOOD: MICROECONOMIC DIVERSITY

The Brazilian Federal Government launched the Minha Casa Minha Vida Programme in 2009 with the main goals of expanding the access opportunities of low-income families to homeownership, and reducing a historic, massive housing deficit in the country. The programme categorises beneficiaries into three bands of monthly income: up to USD $669,46 (band 1), up to $1297,07 (band 2) and up to $2092,05 (band 3). Nevertheless, Programme and the design of housing complexes have been subject to relentless criticism by experts. Location is a first major issue, and Rio de Janeiro offers a paradigmatic case in that sense. With on-going expansion, West Rio has many areas without adequate infrastructure to support the population, whether they are services provided by the State, such as health, education and public transportation, whether daily activities to support residents, such as commerce and services.

Previous works identified a common practice among developers: to buy large chunks of peripheral land and divide them into several smaller pieces, which are then contracted separately as individual, similar projects (Cardoso and Lago, 2015). These pieces end up functioning morphologically as one large housing complex. It was identified that 71.86% of the housing complexes in the metropolitan area of Rio de Janeiro meet this criterion (Cardoso and Jaenisch, 2014). Rio has received more than 61 thousand housing units. 71% of the housing units are located in West Rio (figure 1). These data reinforce the 2010 Census information (IBGE, 2014), which confirmed that Rio de Janeiro is still in the process of expanding to the west, a process that has been taking place since the 1950s. These large-scale collections of developments, usually made up of complexes with more than 200 housing units, are also said to have impacts on their neighbourhood, considerably increasing the local demand for services and retail.

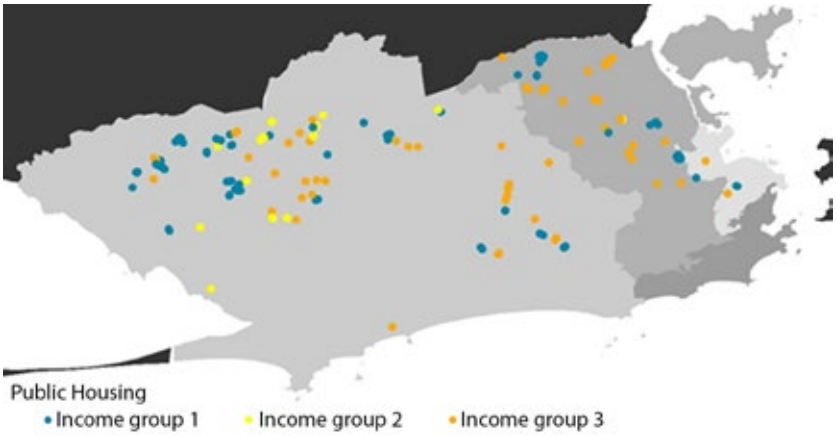

Figure 1 - Distribution of PMCMV developments in the city of Rio de Janeiro (March, 2015)

Due to temporal and logistical reasons, we selected twelve out of 218 projects contracted in 2015 (from which only 63 projects were built by then). Our criteria involved four major issues in the research problem: (a) *architectural typology* (namely, the two most frequent types: H-shaped towers, and slabs); (b) *income levels* attributed to selected cases by the Programme itself (the number of cases per income level is proportional to the overall distribution of complexes per income level in Rio); (c) *location* (according with two main location areas preferred by the Programme, North and West zones); (d) *number of housing units and buildings* per complex (we only considered cases in the second and third quartile of the histogram of distribution of units in the complexes, discarding both the largest and the smaller complexes (25% of the upper end and lower end of the histogram) (figure 2).

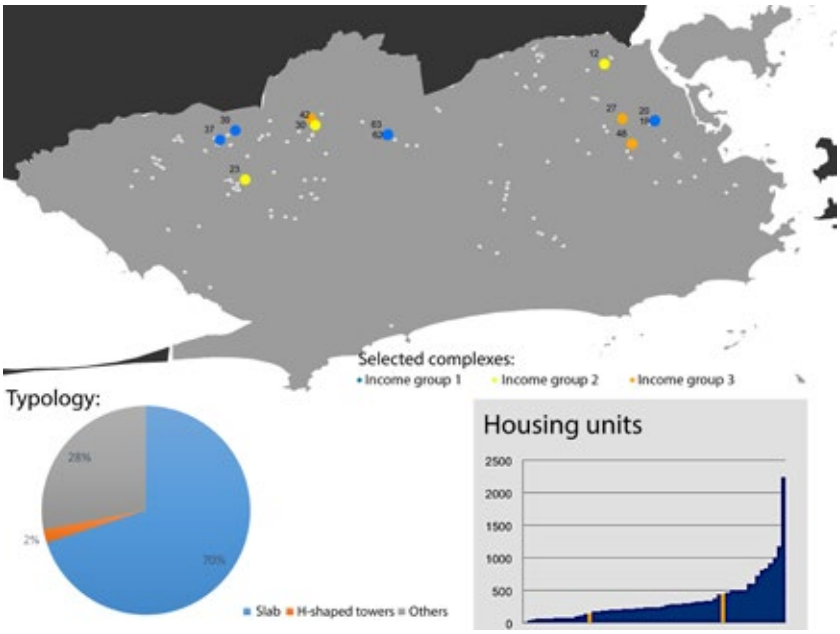

Figure 2 - Location of selected housing complexes and histogram.

In order to verify the arguments of previous critiques to location of the projects, we devised an approach to measure the degree of microeconomic diversity of the environment to support residents, based on surveying land uses within 5 minutes walking distance from the entrance of the housing complexes (radius of 460m - figure 3).

Figure 3 - Example of housing complex with gates for pedestrian counts (radius of 460m from main entrance).

The activities of these areas were classified in two ways: first, in four classic categories from the point of view of urban planning: residential, services, retail and institutional uses. The second one was based on more detailed categories derived from the National Classification of Economic Activities (CNAE), with activities aggregated into 24 categories with sense from the point of view of urban economics (table 1).

CATEGORY
1. Residential
2. Food and beverage (markets, sales, no local consumption)
3. Car repair and auto parts
4. Gas station
5. Construction material (blacksmithing, carpentry)
6. Household goods
7. Pharmaceutical products, perfumes, cosmetics
8. Clothing, footwear, jewels
9. Liquefied petroleum gas (LPG - cooking gas)
10. Informal retail
11. Hotels and similar
12. Restaurants and other food and beverage services
13. Street-vended foods
14. Professional, technical and scientific activities
15. Administrative activities
16. Public administration
17. Education
18. Human health and social services
19. Arts, culture, sports and recreation
20. Transportation and storage (parking lots, warehouse and storage areas)
21. Information and communication activities
22. Financial and insurance activities
23. Church and other associations
24. Other activities and services

Table 1 - Categories of urban activities used in the analysis of diversity. Source: Authors / CNAE.

The degree of diversity of activities was based on the information entropy formula proposed by Shannon (1948). Diversity is a measure of distribution: a perfectly homogenous distribution of activities along a given number of categories finds maximum diversity. If activities are concentrated in a single category, diversity is non-existent. The measure takes into account the number of activities (land uses) in relation to the total number of activity categories, and varies from zero to 1. Empty plots were considered in the proportion of activities in analysed areas, but excluded from calculation, as they do not represent a microeconomic activity. The degree of diversity was analysed in 10 surrounding areas of 12 housing complexes in a comparative study between complexes of different zones.

$$Ei = -\frac{\sum_{j=1}^{k}(Pji)(LnP\,ji)}{Lnk}$$

Ei = entropy index in sector i

Pji = parcel occupied by activity j in sector I Or proportion of units with activity j

K = number of categories of activities considered (land use)

Ln = natural logarithm

Then we could test some axioms of urban economics: the relation between urban diversity, density and distance. Our empirical study also included variables like commuting time to the central business district and density according to 2010 Census data (table 2).

Housing complex	Distance CBD (km)	Density Hab/ ha	Diversity 24 categories	Diversity 4 categories	Integration Rn	Integration R3
12	16.0	108	0.4	0.61	0.36	2106705.19
19	13.2	233	0.4	0.71	0.34	1474754.47
20	13.2	233	0.4	0.71	0.34	1474754.47
23	43.8	34	0.31	0.47	0.25	1700813.76
27	17.0	119	0.5	0.68	0.33	1443623.76
30	38.5	27	0.3	0.44	0.30	1507468.53
37	46.0	34	0.25	0.52	0.27	1815151.82
39	44.7	27	0.18	0.27	0.28	1221199.56
42	38.0	27	0.21	0.28	0.29	1011758.63
48	11.2	116	0.56	0.71	0.34	1492244.86
62	57.3	17	0.28	0.41	0.31	2261443.41
63	57.3	17	0.28	0.41	0.31	2261443.41

Table 2 - Distance and commuting times to CBD, local density and diversity.

Analysing the convergence levels between distance, population density and diversity of microeconomic activities pointed out by studies in urban economics, we have found some high statistical correlations (table 3): the greater the absolute distance to CBD, the lower the density (-0.85); a strong positive correlation of diversity and density considering four categories of activity (0.83) and 24 categories (0.64); along with strong negative correlations of diversity and absolute distance (-0.82 for four categories, -0.80 for 24 categories).[1] Topological accessibility follows these trends, with strong positive correlations of integration Rn (average for street segments within a 460 radius around housing complexes entrance), density and measures of

1 Correlations based on the Pearson coefficient range from zero to -1 or +1 (perfect negative or positive correlation). The statistical significance test (p-value) examines the probability of an observed result if it repeats or arises by mere coincidence. P values equal to or greater than 0.05 are not statistically significant, according to the conventionally adopted parameter of 95% confidence.

diversity. Correlations of absolute distance and global integration find empirical sense (0.70), whereas correlations of integration R3 and distance, density and diversity have found no statistical significance.

Correlation Matrix: Pearson					
	Distance CBD (km)	Density (Hab/ha)	Diversity 24 categories	Diversity 4 categories	Integration Rn
Distance CBD (km)	1.00	-0.85	-0.80	-0.82	-0.70
Density (Hab/ha)	-0.85	1.00	0.64	0.83*	0.66*
Diversity 24 categories	-0.80	0.64*	1.00	0.89	0.70
Diversity 4 categories	-0.82	0.83*	0.89	1.00	0.67*
27	17.0	0.5	0.68	0.33	1443623.76
30	38.5	0.3	0.44	0.30	1507468.53
37	46.0	0.25	0.52	0.27	1815151.82
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62	57.3	0.28	0.41	0.31	2261443.41
63	57.3	0.28	0.41	0.31	2261443.41

Table 3 - Correlations of absolute distance and CBD, integration (Rn), local density and diversity. P-values < 0.01 except * (< 0.05)

However, complexities and *divergences* in this relationship become more evident when we plot the distance of housing developments to the CBD in relation to the diversity level of microeconomic activities (figure 3). We can see that diversity falls, especially from 16 km away from the CBD, from a trend of 0.40 to 0.20, with variations up to 0.30, considering the 24 categories in the 460-meter radius from each housing complex (figure 4).

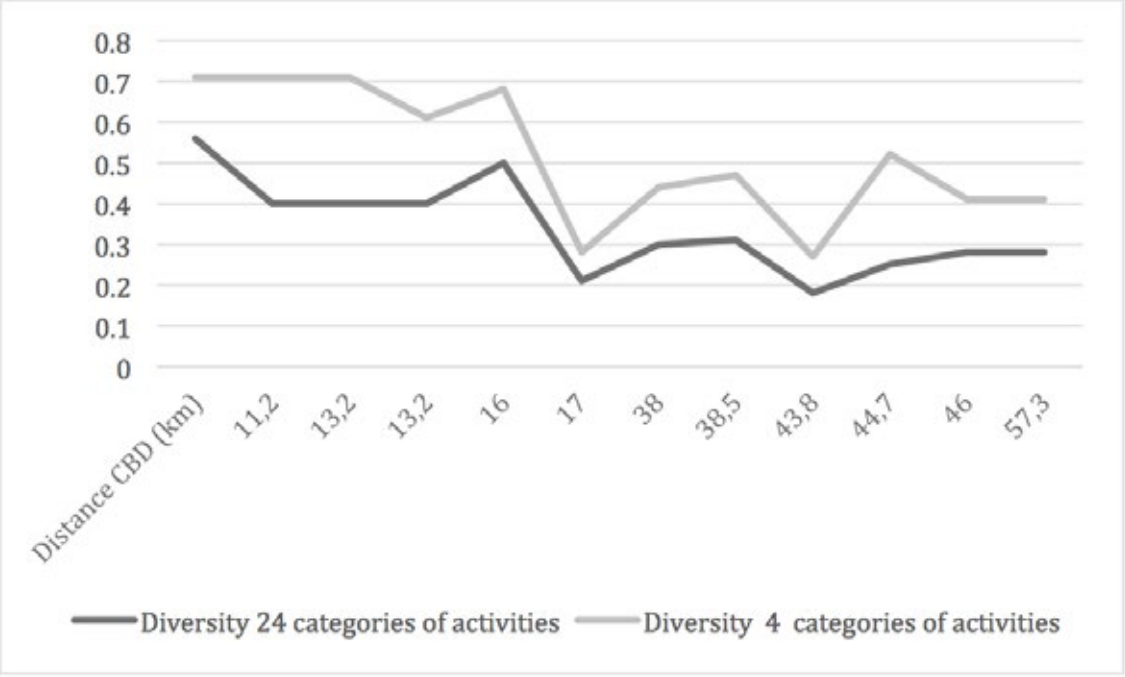

Figure 4 - Diversity (Y axis) and distance to CBD (X axis).

The numbers confirm to some extend the axiom in economics since Alonso's (1964) monocentric model: the further away from the centre, the lower the diversity of activities around housing complexes. But there is no linear decay of diversity along with the increase of distance. This indicates complexities such as potential local centralities (e.g. polycentric structures, captured in Zhong et al, 2015 and Shen and Karimi, 2016) and divergences between land use distributions, accessibility levels, and distance (Netto et al, 2012; Netto, 2017).

One of the consequences that the low diversity of activities have for residents of is the greater need of movement around the city in search of retail and public services, like access to health and education. These data confirm previous critiques made to the programme regarding location and areas with little supply and diversity of services to support the daily activities of residents, especially considering diversity levels found in consolidated areas such as Copacabana and Ipanema (0.82 and 0.71, respectively).

3. INTERFACES OF HOUSING COMPLEXES AND NEIGHBOURHOOD

Considering that accessibility relates to the connectivity of the grid and that this is a factor of attraction, increasing the possibility of connections with the city also tends to increase the possibility of access to commerce and services. We also know that the street network directly relates to land uses and architectural densities that will be added to it – factors at once combined in the generation of multiplier effects on pedestrian movement (cf. Hillier et al, 1993) and dependent on it. We also know that each of these urban patterns (land use and pedestrians) involve different *temporalities* of production: street networks change in the course of centuries, architectural densities and land use patterns may emerge and become stable for decades, while pedestrian movement is the most volatile of these systems and may change rapidly according to contingencies (Netto et al, 2012; Netto, 2017).

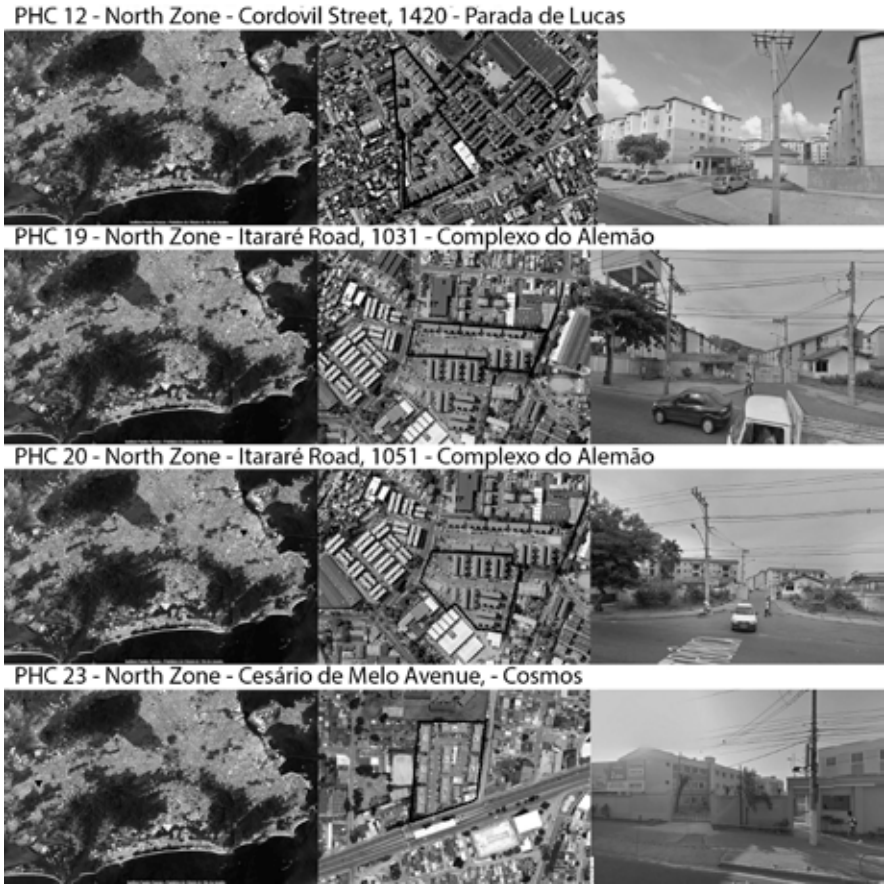

Figure 5 - Location, neighbourhood and aerial view the public housing complexes 12, 19, 20 e 23.

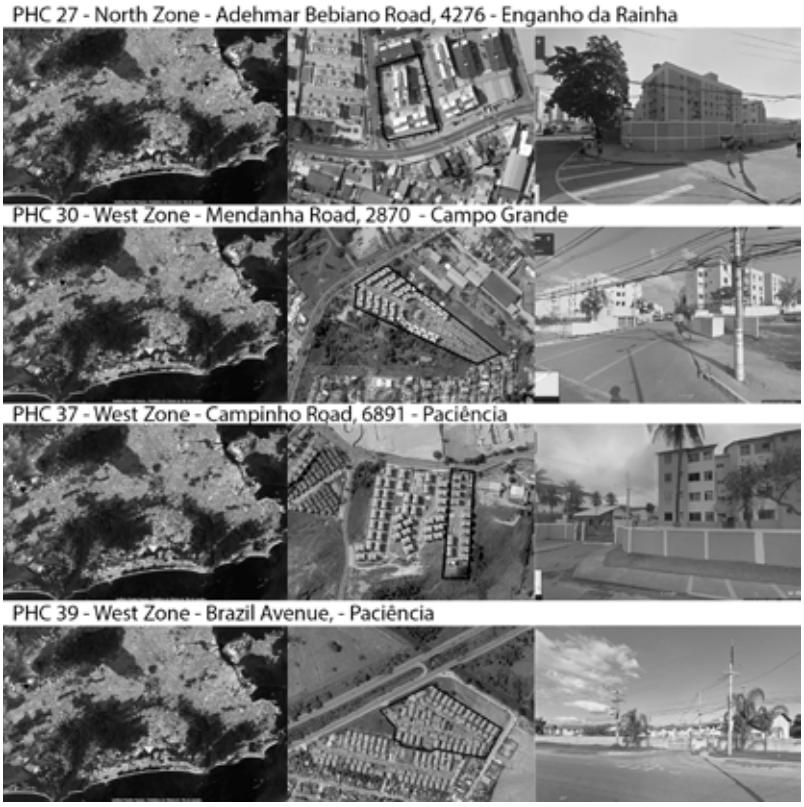

Figure 6 - Location, neighbourhood and aerial view the public housing complexes 27, 30,37 e 39.

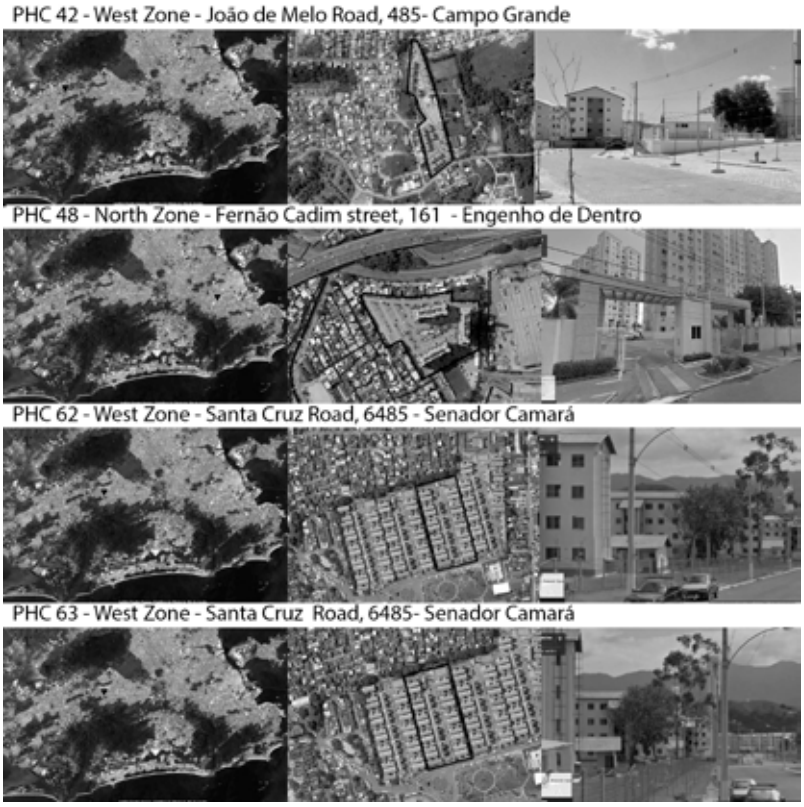

Figure 7 - Location, neighbourhood and aerial view the public housing complexes 42, 48, 62 e 63.

In order to analyse the functional relationship between new housing complexes and neighbourhood (figures 5-7), we analysed street segments within a radius of 460m from housing complexes, measured their levels of accessibility (global and local integration), morphological features (number of plots, type of plot interface or the relationship of façade and public space mediated by fences, walls or open plots) and assessed levels of pedestrian movement.

Regarding accessibility, there is a correlation of -0.31 (p-value 0.06) between local integration and segment length. This indicates that the highest accessibility rates are more likely to be found in shorter streets. Local integration finds a positive correlation with open plots (0.51 | p-value < 0.01), that is, there is a tendency of segments with higher accessibility rates having more open plots than walls. Open plots also find a positive correlation with pedestrian movement (0.38 | p-value < 0.05)

In turn, correlation between microeconomic diversity (activities on the ground floor) and open plots suggests a positive association (0.37 | p-value < 0.05). Accessibility continues to show its strength when we analyse its correlation with pedestrian movement (0.42 | p-value < 0.01), indicating that streets with greater local integration and open plots tend to have a more intense pedestrian movement.

Summing up, correlations suggests multiplier effects between accessibility and morphological features, where streets with greater accessibility try to attract plots that connect with open façades, allowing a greater diversity of microeconomic activities that in turn attract more pedestrians (cf. Narvaez et al 2012; 2016). When large housing complexes are built in streets with high accessibility but surrounded by walls and exclusive residential activities, they become large enclaves in the neighbourhood, not allowing a direct interface of dwelling and street, preventing changes of land use and directly impacting pedestrian movement.

4. IMPACTS OF HOUSING COMPLEXES ON LOCAL ECONOMIC DIVERSITY

Another key problem analysed regards possible consequences of the construction of the housing complexes, where new gated communities located in areas of low density could become vectors of transformation of the microeconomy in their neighbourhood,. Considering a dynamic scenario, transformations including increases in the diversity of activities could happen over time. Any potential increase in diversity would meet the needs of these new residents in a circular cumulative effect a la Myrdal (1957), where new residents would generate demand, and microeconomic diversity would increase, stimulating new demands (figure 8).

Figure 8 - Dynamics of the influence of residential complexes on the diversity of the environment.

Figure 9 - Map of land use for the years 2011 and 2015.

In order to analyse the microeconomic impact of the housing complexes in their surroundings, a comparative study was carried out focusing on the degree of diversity before and after construction (figure 9). We analysed an area of 3.15 km² around 11 projects in Campo Grande (West Rio), which total 3753 housing units and approximately twelve thousand new residents, between 2011 and 2015.

Figures indicate an increase of 118% of households and a 121% increase of residents in the analysed area, representing a significant growth of density in a five years period (table 4). Further data were collected through field surveys and analysed according to density, land use, activity and microeconomic diversity.

Land Use Classification	2011	2015	Growth
Residential	781	902	15%
Retail	64	87	36%
Service	64	125	95%
Institutional	29	30	3%
Industrial	14	13	-7%
Empty	65	50	-23%

Table 4 - Variation in land uses in plots of Campo Grande, West Rio (2011-2015).

We have found a growing presence in all types of activities in this area since housing complexes were built. We highlight the great increase of services (growth of 95%), while the retail in the area had a growth of 36%. This difference can be explained by the trend of concentration of commercial activities in large hypermarkets and shopping malls, and services tend to be dispersed in small units, each one within its specialty (Almeida, 1997).

This intensification of activity is also perceived in the degree of diversity, the diversity level was 0.282 in 2011 for four categories, increasing to 0.318 in 2015. In turn, our analysis for 24 categories of economic activities based on the National Classification of Economic Activities (CNAE) (see table 2), which captures variations with more precision, shows a diversity level of 0.381 in 2011, and 0.445 in 2015 (table 5).

Diversity	2011	2015
4 categories	0.296	0.331
24 categories	0.381	0.445

Table 5 - Evolution of microeconomic diversity in Campo Grande, West Rio.

So there is a substantial increase in the diversity of the microeconomic activities along with increases in the number of activities and population density. The arrival of the twelve thousand residents of the Minha Casa Minha Vida projects creates a mass of new final consumers, increasing demand and the presence of suppliers. The location of microeconomic activities can be explained by their pursuit of the consumer market – and here space matters, as the attractiveness of the market depends on the size of its clientele (Fujita and Thisse, 1996). A larger consumer market generates centripetal force capable of attracting retail and services to the area, while reducing transportation costs and daily efforts. The relationship between density and diversity found empirically therefore confirms one of the axioms of spatial economics: a strong association, mutual stimulus and positive externalities between these urban patterns (Jacobs, 1969; Glaeser, 1992; Henderson, 2002).

5. MEDIATING THE TRANSITION FROM 'DEMAND' TO 'LOCATION': THE HIDDEN MORPHOLOGY OF PLOTS

Of course we are looking here only at the 'tip' of the economy, as final suppliers involved in retail and services, and final consumers – the last stage of long cycles of production and intermediary exchanges. We are finally in a position to assess the role of urban structure in the transition from the social and microeconomic demands of residents to the way suppliers are able to materialise their activities into new locations in an area, changing land uses and density patterns along the way. We know that accessibility and density have roles in the change of diversity – but is there more to this? What are the contingencies at play? Are there more active structural features, perhaps underestimated in classic urban and microeconomic approaches?

Our examination of land use changes in West Rio led us to a curious observation. We noticed that the 'infrastructure' of architectural morphology, namely the plots that define parcels of

property, seem to take part in the actual process of urban transformation, allowing changes to emerge or slowing them down. This suggests a possible induction: the possibility that plot structures (especially regarding size) may either ease or refrain change in land uses and the densification of urban form.

Recent research has shown that the process of convergence of patterns such as accessibility, density and land uses is in fact quite problematic. Changes in the realm of collective actions (e.g. new residents with new consumption needs) have to be read by other actors (suppliers). Suppliers have to find now local spatial opportunities in order to meet the new demand. All these actors have to learn about spatial advantages such as the best accessibility levels and favourable land values. New tenants have to be installed, buildings built or adapted, so that land uses can change. This is a process mediated by information diffusion, an economy, and different materialities (in practices and in spaces) and temporalities (in demand, creation of new activities, transformation of actual spaces and buildings) at play. It is a complex, challenging process – and one that goes virtually unnoticed. We suggest that the 'hidden morphology of plots' is one of the material layers mediating it.

Let us see our case in point. Maps indicating changes in land uses (figure 5) show that microeconomic activities and diversity is concentrated in streets where the of plots are the small plots facing directly onto the street, are the dominant type. In their turn, large plots used for the housing projects have architectural models that do now allow spatial change. These models freeze any possibility of change expressing microeconomic potentials around them. Most of other large-scale plots also keep their previous land use and continue stable as a pattern, as their land values and size require larger, more complex investment. A particular, small plot size shows higher change rates in their land uses. This indicates that the size of the plots might have a role in the speed of changes in land uses. Of course a single observation can only suggest possibilities of research and offer new hypotheses to be tested, namely around the role of land parcelling as part of the condition and rate of diversification of activities in an urban area.

6. SOME FINAL OBSERVATIONS

Traces of the impacts of housing complexes in their surroundings empirically collected in Rio de Janeiro suggest that these large-scale programmes can actually become relevant vectors in urban dynamics and transformation, given that their location have potentially extraordinary implications in local economic action. However, what can be perceived is that this microeconomic impact is reflected in a consolidated mesh and with small plots that allow the change of use, which the ventures in the form of condominiums do not allow. The rapid changes observed suggest a tremendous interactivity between urban subsystems, as the location of new residential complexes even in distant, low-density areas with fragmented street networks find new relations in intensifying microeconomic activities and diversity.

Our approach also allow us to reassess arguments typical in the criticism regarding the location of housing complexes and the practical support to be found in their areas. Distance, density and diversity are problems felt by new residents. In time, residents themselves become agents of self-organisation, minimising initial problems. Other findings indicate the following:

- There are substantial differences in the performance of different locations as far as accessibility and spatial segregation is concerned, which correspond to differences in diversity, interesting from the point of view of residents.
- There are potential implications between the interfaces of housing complexes and their neighbourhoods and pedestrian movement. The model of walled, gated communities replicated *ad infinitum* by developers and their negative impacts on the connectivity of street system seems harmful to the vitality of the environments where they are built.
- We found signs of a possible influence of land subdivision on the rate of change in land uses in areas of dispersed expansion, directly affecting housing complexes and their surroundings, which seem to deserve more theoretical and empirical attention.

Negative factors can be minimized through urban planning policies and more rigorous regulations regarding the scale of projects, possibilities of mixed use, and avoidance of gated communities (at least bordering one another) – in addition to studies of location and impacts within neighbourhoods.

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