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A new centrality or a planned segregation?

Investigating spatial traits of Reserva do Paiva enterprise

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ABSTRACT

This paper analyses how the spatial configuration of an ongoing urban expansion project at Recife's Metropolitan Region (north-east Brazil) might characterize socio-spatial segregation. The case study is representative of an urban expansion model applied in developing countries. The economic dissociation with local reality, modernization promises through IT systems, strategic location and large urban scale are characteristics. In Brazil, the tradition of self-segregated gated communities appears to guide the concept of this model of urban expansion. The main difference being the size of intervention and consequences to social-spatial life. As perceived, self-segregation historically occupies edges of urban fabric, away from socioeconomic inequality problems and chance encounters with others (Villaça 2001). In that sense, Reserva do Paiva differs from it by its strategic location, connecting municipalities that were apart, being close to industrial and business complex, besides the prized beach landscape.

To test the hypothesis that the way space was designed, within its space configuration, is at the core of the problem and reinstates spatial segregation rather than a new centrality, *integration, connectivity, intelligibility,* and *control* are investigated from a metropolitan axial map, analysed *globally* and *locally*. Findings reinforce Reserva do Paiva as a large self-segregating coastal urban structure, with asymmetric access to its controlled urban space, not contributing to integration in south settlements in a large urban scale. The self-segregation tradition not only continued, but it has spread in proportions.

KEYWORDS

Socio-spatial segregation, Urban expansion, Space syntax, Recife.

1 INTRODUCTION

A morphological analysis of Reserva do Paiva real estate urban expansion is presented in this paper. The proposition locates in north-east Brazil at Recife's expansion area. This paper identifies social-spatial segregation pathologies spotted by urban geographic research on this case (Barbosa 2014, Souza et.al 2015 and Lima 2015).

The study case consists of an urban expansion model identified during a master's research. Since the mid 2000's, master plans of new centralities on the edge of consolidated urban grids have been sold to developing countries by real state companies. They have in common the scale[1], the economic dissociation with local reality and the modernization promises through IT (Information Technology) systems (Watson 2013, Sposito 2013).

1.1 From gated communities to an urban paradox

In the mid 2000's, *smart cities, planned neighbourhoods, creative cities* and *eco-friendly* labels appeared in urban expansions models. In Brazilian cases, they were presented as an exclusive, secure and isolated urban solution, perpetrating the concept of gated communities. The main change is in the scale (Souza et.al 2015).

Gated communities for the wealthy are common in Brazil since the late 1970's, as isolated residential blocks at the periphery. The recent real estate models took urban proportions, offering urban facilities, commerce, services equipment and several gated communities at the same territory (Caldeira 2000, Sposito 2013). That changes significantly the consequences. Morphologically it plays another role, occupying large areas between main grids, connecting municipalities that were apart, as the study case. The study case Reserva do Paiva, was a real estate industry response to federal strategic investments. Economic growth resulted in the development of Cabo de Santo Agostinho industry complex and port, in a municipality south of Recife (figure 1). The need for specialized work labour was one of the main reasons for Reserva do Paiva project, focused on luxury equipment and housing.

[1] In Recife alone, thirteen new urban developments were announced with modern centrality characteristics, resulting in 8,5 thousand acres of speculative land business. The estimates varying from 10 to 1000 thousand inhabitants, between 5 to 30 years to develop (Mendonça 2020). In Africa, Watson (2013) related "modern word class" master plans for seven countries. The propositions offering to house between 25 to 890 thousand people in a business called "last development frontier" (Watson 2013, p. 216) by the real estate industry.

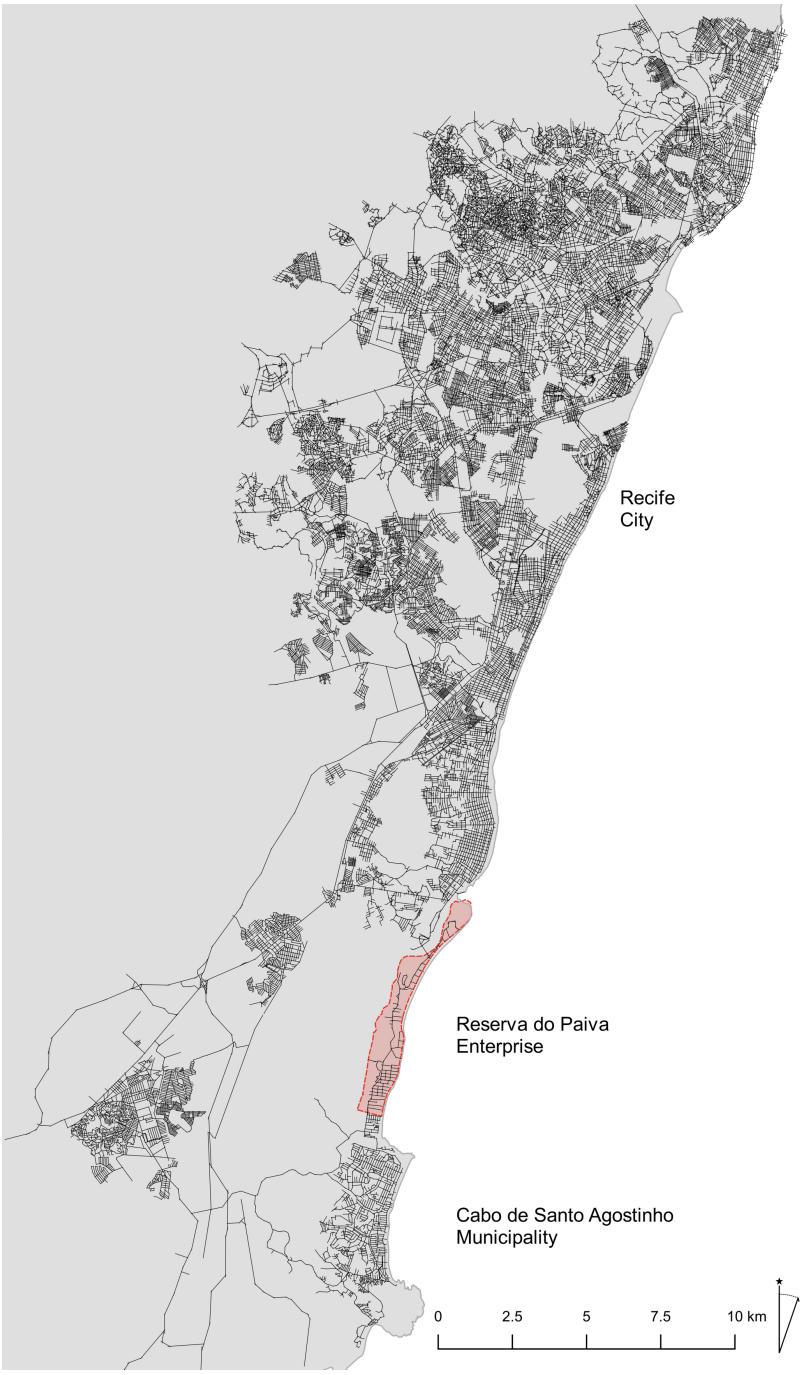

Figure 1: Case study enterprise location between Recife and Cabo de Santo Agostinho.

Although not identified yet as morphological type, these real state propositions can be pointed as an urban solution product, as if they could function independently from the existing urban grid (Watson 2013, Souza et.al 2015). Two conflicting ideas emerge in this concept: *centrality* and *isolation.* Could a centrality be developed within a concept of exclusivity? The entrepreneurs thought it might work, due to its favourable economic context (Odebrecht 2014).

Space syntax studies results show that most part of pathologies – decline in urban vitality, property devaluation and increase in criminality - in cities happens in less integrated areas

(Hillier and Vaughan 2007, Vaughan 2007, Hillier 1996). In global segregated areas, microeconomy dynamics tend to have difficulties to develop, as in local segregated grids cultural exchanges and community bonds tend to decrease (Hanson 2000).

As not being a place, but a dynamic that needs a good amount of movement to develop, a centrality distinguishes itself from the rest of the city by higher activity, multiple functions of land use and economic exchanges (Hillier 1999). To increase potential movement, global integration must be in a level to enable movement flow from the main centre, in a short radius distance to main roads or in few topological steps from (Hillier 1999).

These proposed new centralities, at least in Brazil (Sposito 2013) and African countries (Watson 2013), seem a challenge for urban dynamic and easy access. Brazilian cities have different kinds of social-spatial segregation due to its historical social-economic inequalities (Vasconcelos et al. 2013). The one approached here is an intentional movement by the wealthy seeking isolation, well known as self-segregation (Sposito 2013).

1.2 Segregation as a plan

The origin of the term *segregation*[2] in urban studies (Chicago late 1920's) already intentioned to find patterns of urban growth related to poverty and exclusion. Although not in a morphological language yet, they mapped patterns of occupation in sectors related to the main centre (Eufrasio 1999).

As a city phenomenon, segregation is multidimensional. Socio-spatial segregation is a movement that *sociologically* acts upon a determined group of people arbitrating their location in *space* (Sposito 2013). Investigating segregation studies in Brazilian cities, Villaça (2001) observed patterns of centralities development in urban grids. During the twentieth century, they developed along main radials roads coming from the historic centre. The proximity among them came to attention. As the urban fabric grew in the twentieth century, although demands did sprawl with the grid, the centralities did not sprawl as economically expected. One of the conclusions was that even being accessible by main roads, the neighbourhoods were meant to segregate. Studying a particular pattern of segregation in Recife-Brazil, Carvalho Filho, Van Nes and Nascimento (2019) matched data of urban activities, blind interfaces in building scale and syntactic angular choice data. Results found that blind facades impacted on decreasing urban activities even in globally integrated areas. One aspect of the Carvalho Filho et al. (2019) research came to attention. The data gathered on buildings with blind facades (Carvalho et al. 2019) matches significantly with centralities patterns developed in the 20th century in Recife[3]. In

[2] The Chicago School at Chicago University, developed innovative urban sociology studies in the first half of the twentieth century. The main studies here referred were made by Park, McKenzie and Burgess, regarding matching empiric sociological data with urban study models (Eufrasio 1999).
[3] In "3.2 Urban scale implementation context", a map locating the centralities developed through the 20th century in Recife is compared with the distribution of buildings with segregated interface gathered by Carvalho et al. (2019)

other words, the will to self-segregate pointed by Villaça (2001) can also be identified in a block scale.

Two studies in Natal-Brazil (also north-east Brazil) also relate urban fabric segregation with urban activities and distinct social groups distribution (Carmo 2014, Donegan 2015). Both authors analysed a southern coastal expansion area, Ponta Negra beach. Carmo (2014) indicated a recent increase of gate communities at the area, decreasing access in a block scale. On the other hand, Donegan (2015) identified a significant variety of buildings typologies and functions at the shore, that added with high global integration results mixing a variety of social groups, and a neighbourhood with many touristic uses.

Consistent studies have been made on Reserva do Paiva case (Barbosa 2014, Souza et.al 2015 and Lima 2015), but none of them focused on urban morphology and spatial configuration. Understanding implications of location with day-to-day life and as expressions of spatial segregation (Vaughan, 2007; Vaughan and Arbaci, 2011), urban local planning can be aided by a multidisciplinary approach with spatial configurational. This local case can also show to be representative of a wider phenomenon.

Following, the data of the study case gathered is presented, first briefly contextualizing with project numbers, then how syntactic data and methods were applied in the analysis. This paper aims to start clarifying morphological consequences of the study case by a comparative analysis using axial map data before and after implementation, relating to the global system of the city grid and to the local scale of intervention.

2 DATASETS AND METHODS

To analyse Reserva do Paiva morphology, a local study was made based on the project, that also helped address street network changes. This information was subsequently used to update a larger scale analysis of the enterprise street network location in relation to Recife city. Reserva do Paiva project, was researched from municipality plans and the Odebrecht company construction website[4], in terms of public-private roads, urban blocks and types of uses as registered by the project. This data was mapped, analysed and visualized in Qgis program.

Giving its urban proportions, urban scale data was analysed. The immediate grid connected municipalities of Cabo de Santo Agostinho and Jaboatão dos Guararapes were added to Recife and Olinda, to the north. Regarding the target client population of tourists and high-income workers, connections between Recife large urban fabric and Reserva do Paiva plays a major role, as they social-economically connected with the metropolitan area.

[4] https://www.reservadopaiva.com.br/

The urban spatial configuration is represented by the axial map, that was used to process topological measures to analyse potential movement and accessibility. The axial map of the urban fabric is extensive, part of it was made available by MDU/UFPE[5] with the axial map of Recife and Olinda made by Lucas Figueiredo (PPGAU/UFPB[6]), updated in 2019 to include Jaboatão dos Guararapes and Cabo de Santo Agostinho grids. Two variations were made, one considering routes in 2006, without Reserva do Paiva street network, another for 2019 that includes Reserva do Paiva street network. Reserva do Paiva fabric made the first coast connection between Cabo de Santo Agostinho and Recife main grid. The cartographic data of Cabo de Santo Agostinho was not complete, so Google satellite images were used to complete and build the 2006 and 2019 grids. The axial map was made using cartographic bases of the cities and municipalities in AutoCad, exported for calculations in DepthMap[7] and finalized in Qgis. Measures of *connectivity*, *control*, *local* and *global integration*, and *intelligibility* were taken and analysed.

The next section presents Reserva do Paiva urban design and morphologic syntactic analysis, discussed with centrality intentions of the developers, regarding segregation intentions pointed by urban geographic researchers. Cabo de Santo Agostinho urban development department municipality hall gave access to Reserva do Paiva master plan's documents and maps, which made possible to initiate morphological analysis.

3 RESERVA DO PAIVA, A PLANNED TRADITION

This section first introduces Reserva do Paiva master plan in its extension, road hierarchy, allotment, private and public areas and land use. Second, the location in the context of centralities sprawl in the twentieth century in Recife. Finally, a diachronic analysis is presented using syntactic data grid development; in 2006, before the Reserva do Paiva implementation, and in 2019 when the grid was fully functional. The section is followed by the paper's discussions and conclusions.

3.1 First morphologic data and preliminary local observations

Reserva do Paiva was planned for 45 thousand inhabitants plus 45 thousand expected workers and visitors, in a municipality with 210 thousand inhabitants with medium income under minimum wage[8]. The implementation opening happened in 2007 with road and allotment system complete, expecting the whole centrality to be developed in 2037 (Mendonça 2020).
The project occupies 8.5 kilometres of coastline, distributed in 1300 acres. The street hierarchy has two main levels: the main road, in north/south direction, distributes access to the blocks through the local streets. The third level are "servitude access", public access to the beach

[5] Post-graduate Program in Urban Development of Federal University of Pernambuco.
[6] Post-graduate Program in Architecture and Urbanism of Federal University of Paraiba.
[7] Depthmap was created by Alasdair Turner at the Spatial Syntax Lab at UCL (University College London) and is available at: https://www.spacesyntax.net/software/
[8] Last IBGE (Brazilian Institute of Geography and Statistics) census expected data for population in 2021 and its work and income.

designed to go under a gated community in the second sector. In the first three sectors, the blocks occupy large areas, but the most part of the perimeters have no connection to the local streets, as they don't go around the blocks. The distribution access happens by a local street, entering the block area, or through the main road, but very sparsely. For example, in the second sector, by the beach, a gated community has only two entrances placed 500 meters apart (figure. 2, map 3).

Inside the private blocks (the majority of them, figure 2, map 2) are internal distribution of collective spaces and access to buildings. Only in the fourth sector the grid goes around smaller size blocks, approximately 250m x 50m, enabling more access possibilities. There are eight high standard residential gated communities, five in operation; a service complex with business buildings interconnected with an Open Mall; a hotel with club house extension and restaurant service; a private school and two operational public spaces. The public blocks were meant to occupy 37% of the enterprise, turning out to be only 16,32%, road system included. The zoning stablished large blocks of same land use, resulting in a monofunctional urban layout and giving direct access to the beach by private blocks.

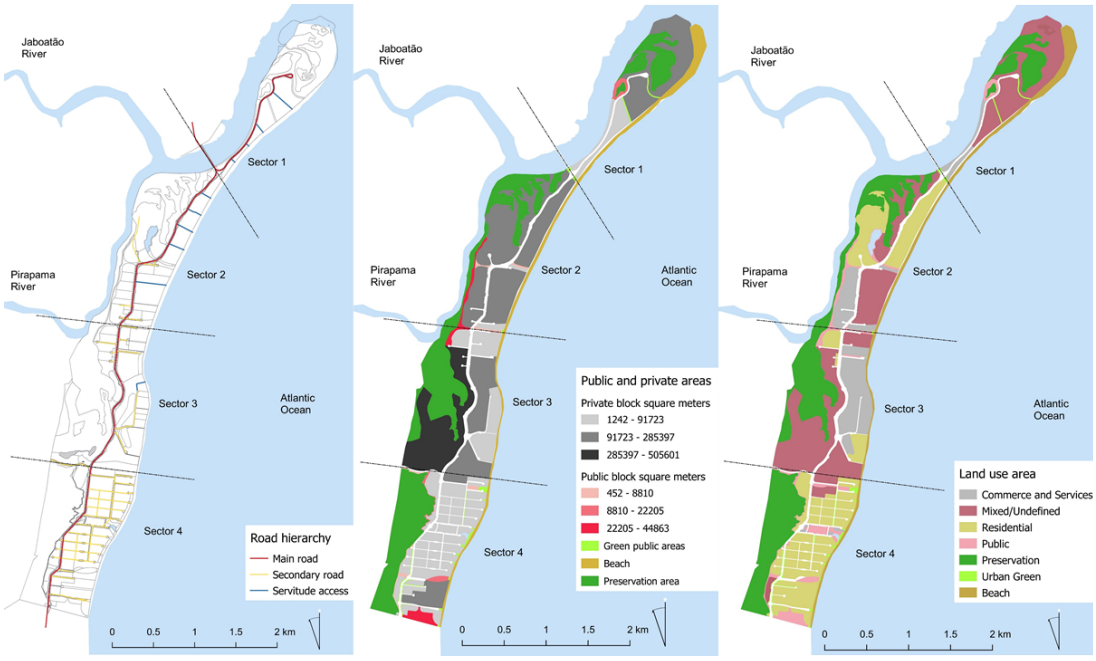

Figure 2: From left to right, maps of Road hierarchy, Public and private areas and Land use areas. Source: the authors.

Reserva do Paiva development, celebrated by media and developers as an *eco-friendly* urban solution[9], has a strategic implementation. Not only its closer to Cabo de Santo Agostinho industry complex and port than the traditional Recife wealthy centralities, but it confirms Villaça (2001)

[9] "Reserva do Paiva" name came from a preserved area with native vegetation. "Reserva" means "preserved area", "Paiva" is the name of the beach along all the project coastline.

predictions. Reserva do Paiva is a continuation of the centralities sprawl tradition in Recife, developing close to each other in main radials roads from the historic centre (figure 3).

In early 20th century the wealthy neighbourhoods occupied the west area, sprawling to south coastline areas through next decades. Reserva do Paiva came to develop Cabo de Santo Agostinho coastline in 2007. Another evidence to self-segregation intents can be observed as the blind building's facade data of Carvalho Filho et al. (2019) coincides with the wealthy historical centralities (fig.3).

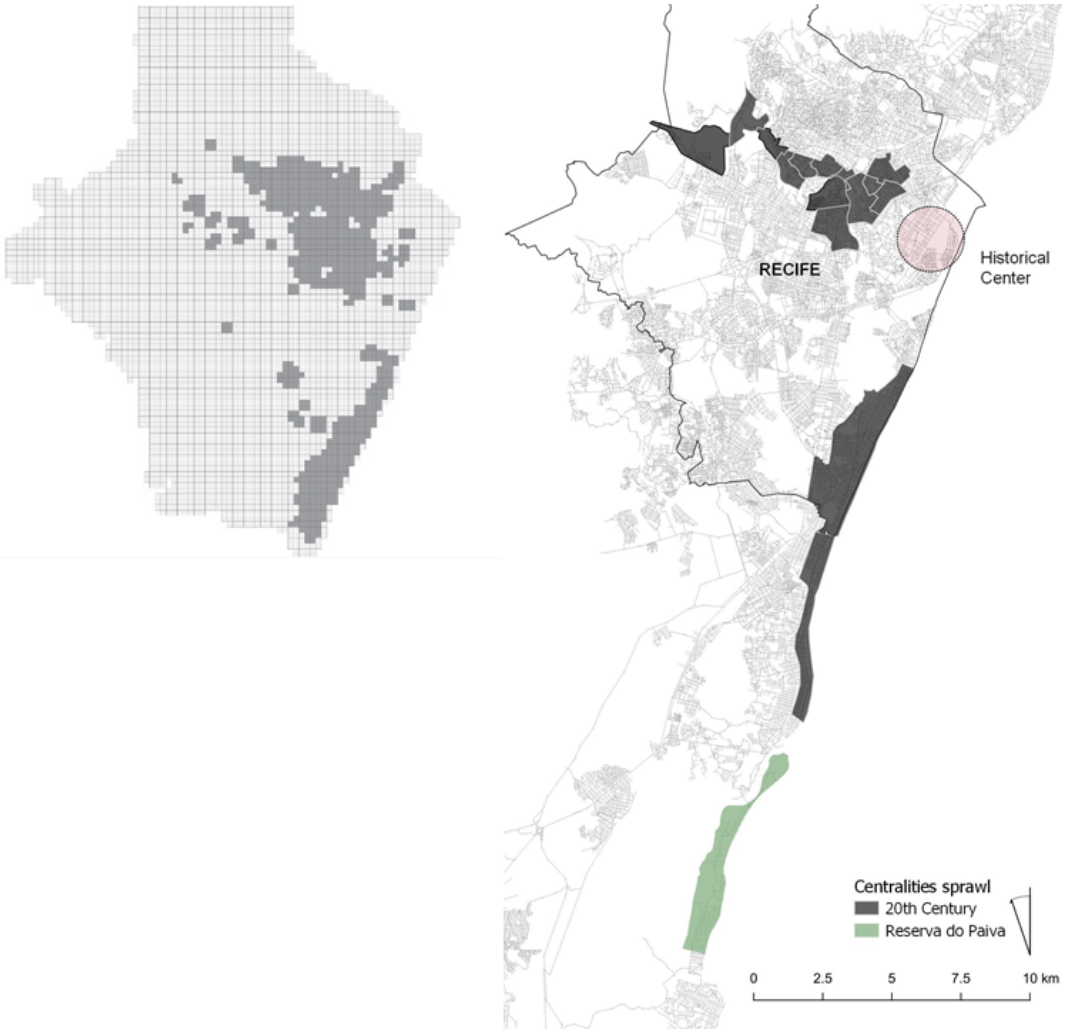

Figure 3: On the left represents the location buildings with blind facades (Carvalho et al. 2019). To the right, the historical development of wealthy centralities mapped and the location of Reserva do Paiva, developed by the author with Qgis.

As the Wilson Campos Jr. bridge was inaugurated in 2010 north of Reserva do Paiva development, Cabo de Santo Agostinho had its first coastal connection with Recife main grid. Jaboatão river was a natural obstacle to grid expansion, overcame by the bridge, connecting with an important coast radial road in Recife system.

Despite the absent coastal connection, and the historical void in the area, Cabo de Santo Agostinho have already had developed important smaller centralities to the south, through other

inland connections with the municipality main centre. Once a summer holiday location, the area has been developing consistent urban activities. In that sense, Reserva do Paiva has a crucial social-spatial influence.

3.2 Reserva do Paiva insertion in the grid

To measure how Reserva do Paiva has consequences in the potential movement of the grid, *connectivity*, *control*, *local* and *global integration*, and *intelligibility* were taken with the axial map. Observing the location relevance and economic strategies involved since the design, the first analysis is related to RMR[10] grid before Reserva do Paiva implementation. The integration core is west from Recife's main centre, spreading more intensely towards south and west. North from the integration core the terrain is less plain, there are neighbourhoods on the hills and self-developed occupations, which makes it a more fragmented grid. Important roads connect radially with the historic centre to all directions (figure 4), in the south coast a more recent regular grid was developed, expanding high global integration results.

When the grid comes apart in south direction, one can notice the important connection Cabo de Santo Agostinho makes through its west grid, developed in earlies 1920's, bringing global integration to the south.

[10] RMR represents the Metropolitan Recife Region cut analysed, including Olinda, Jaboatão dos Guararapes e Cabo de Santo Agostinho and Recife grids.

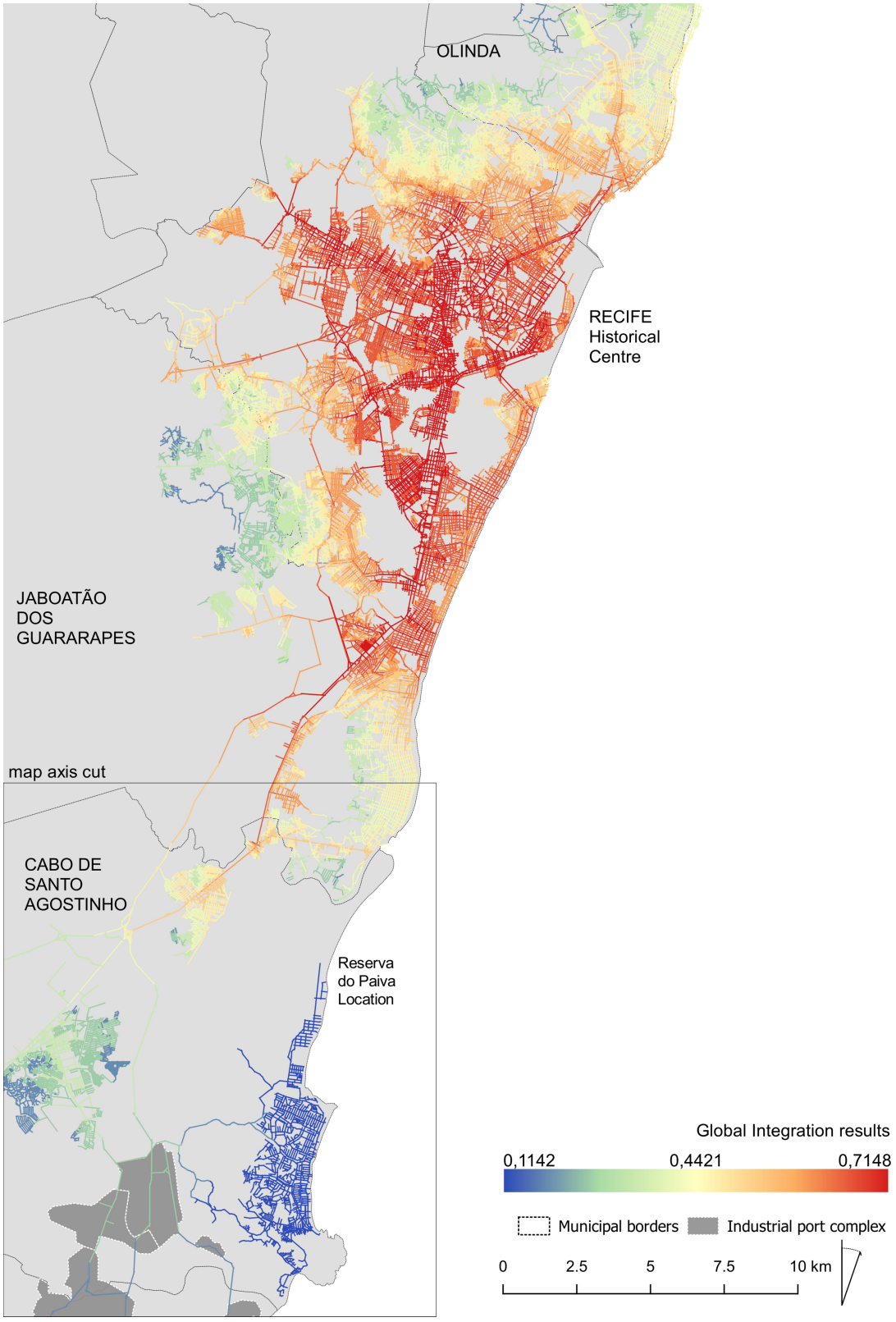

Figure 4: Global integration map of the large-scale system in 2006. Developed by the author in Qgis.

At Jaboatão dos Guararapes coast, the average integration drops to 0,46, compared to the average coast grid integration in the immediate north, 0,59. One of the reasons is the round coastline, fragmenting the urban grid, but also the south void between Cabo de Santo Agostinho coastal

grid and the main grid. Comparing Cabo de Santo Agostinho data with the global system, the number of local intelligibility, associating local (r3) average integration with average connectivity, is higher than the main grid, indicating well intelligible local neighbourhoods (table 1).

Table 1: Syntactic data of Recife Global System and Cabo de Santo Agostinho in 2006.

	Integration Rn		Integration R3		Connectivity		Intelligibility		Control	
	Max.	Med.	Max.	Med.	Max.	Med.	Rn	R3	Max.	Med.
RMR	0,714	0,454	5,072	1,823	94	3,713	0,123	0,491	28,44	0,99
Cabo	0,532	0,286	3,78	1,463	27	2,935	0,097	0,50	15,70	1,0013

Although the average global integration is low, observing the west settlements the results are interesting. The first urban settlement on Cabo de Santo Agostinho to the west, with a direct connection to the global system, has an average global integration of 0,43. Surprisingly high result compared to the south coastal grid of the main system which is 0,46.

Regarding the large void in east/west direction in Cabo de Santo Agostinho, combined with the void that happens at Reserva do Paiva location in the south/north direction, an analysis of these two developments grids axis was made to understand better the development implementation. The historical centre of Cabo de Santo Agostinho is not coastal, it was developed to the west, in two urban patches around the oldest metropolitan arterial roads. The Reserva do Paiva land owners bought the propriety in the 1950's and waited the urban fabric develop around it to maximize profit, until 2007 (Barbosa 2015). In that sense, the coastal void can be partially explained.

To the southeast there is a relatively developed urban settlement on the beaches of Enseada dos Corais and Gaibu, south of Reserva do Paiva. As already seen in the global integration map of RMR, this area has very low results. As the development of Reserva do Paiva grid only began in 2007, fully functional in 2019, this allows a diachronic comparison. The two axes are analysed before, 2006, and after Reserva do Paiva implementation in 2019 (figure 5). The difference in global integration results between the two axis is sensitive, visible by both maps global integration tones of before and after the implementation. The difference is repeated in local integration, which after the Reserva do Paiva allotment, decreases on the eastern axis. Interestingly, the level of maximum control increases (6,16 to 6,25), elevating the average control a bit in the eastern axis after RP implementation (figure 6), indicating urban design intensions.

The difference between the number of axial lines (west axis = 1,927; east axis = 1,368) does not justify the difference in local and global grid integration, especially after the coast connection

implemented with the RP grid, from Cabo de Santo Agostinho to Jaboatão dos Guararapes, integrating the axis to the RMR system.

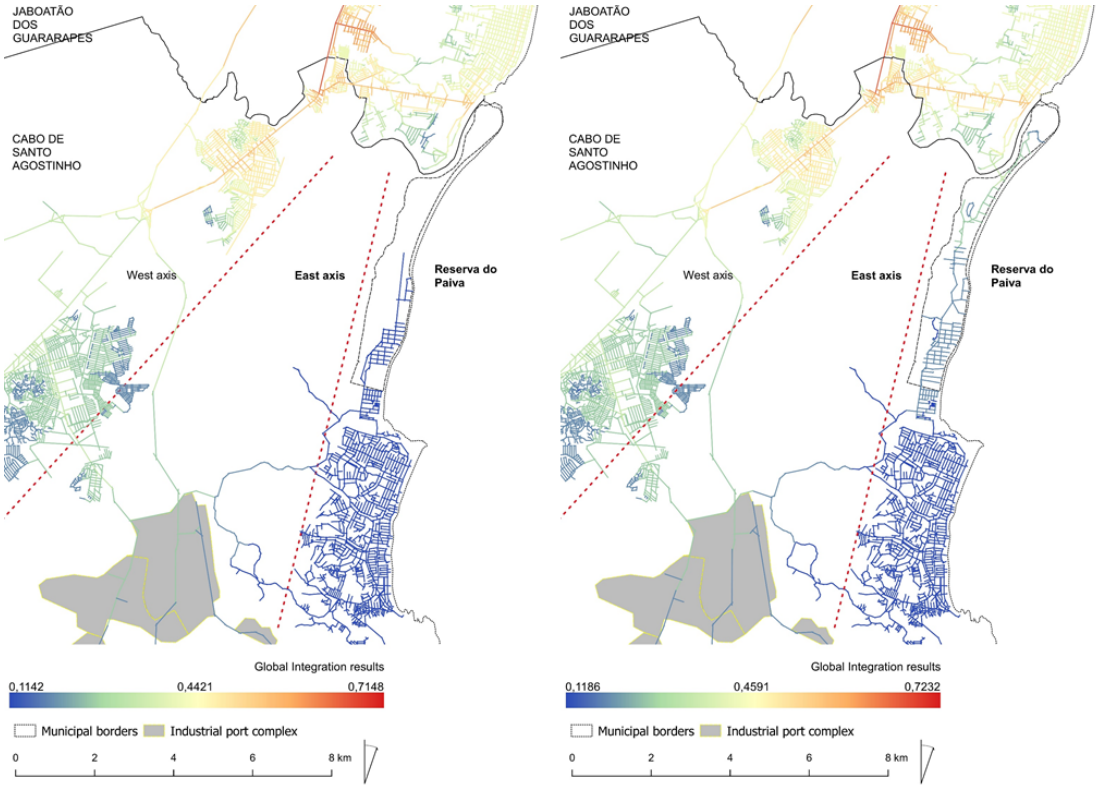

Figure 5: Global integration of the two development axis in Cabo de Santo Agostinho grid. On the left 2006, on the right, in 2019.

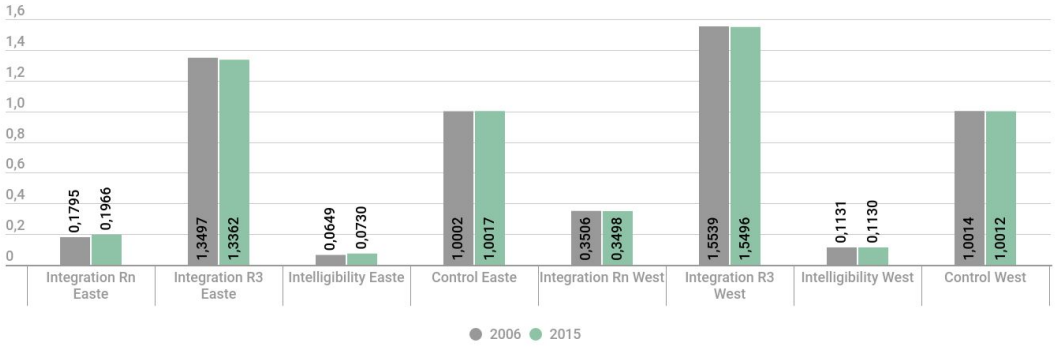

Figure 6: plot of the syntactic data of the Cabo de Santo Agostinho grid axis in 2006 and 2019.

Although the coastal connection between Cabo de Santo Agostinho and Jaboatão dos Guararapes has been built, from the point of view of integration with RMR, the situation does not change either globally or locally, indicating that new routes do little to improve accesses south (table 2). The subtle but significant drop in the connectivity and the increase in the control measure of eastern grid indicate urban design intentions, and are reflected in increased global intelligibility.

Table 2: Syntactic data of Recife Global System and Cabo de Santo Agostinho in 2019.

	Integration Rn		Integration R3		Connectivity		Intelligibility		Control	
	Max.	Med.	Max.	Med.	Max.	Med.	Rn	R3	Max.	Med.
RMR	0,723	0,458	5,072	1,825	94	3,713	0,123	0,491	28,44	0,99
Cabo	0,532	0,296	3,772	1,451	26	2,911	0,101	0,498	15,70	1,0013
RP	0,4038	0,2919	2,4837	1,214	8	2,508	0,116	0,484	6,25	1,00

The east axis has become more globally intelligible because of the lack of street connectivity, corroborating with the lack of global integration. The Eastern grid is intelligible as it indicates that segregation is local and global, noted in street level by low connectivity.

Reserva do Paiva does not implement an expected integration with Recife's main street network, and appropriates a valued natural landscape with traditional leisure: Paiva beach. After Reserva do Paiva implementation, public routes to access this beach have to pass under the development, in narrow tunnels (figure 7). As the main road of the development crosses the settlement, it does not make a continuous path, crossing a poorly constituted sequence of large blocks in a winding path, hampering the awareness of the scale.

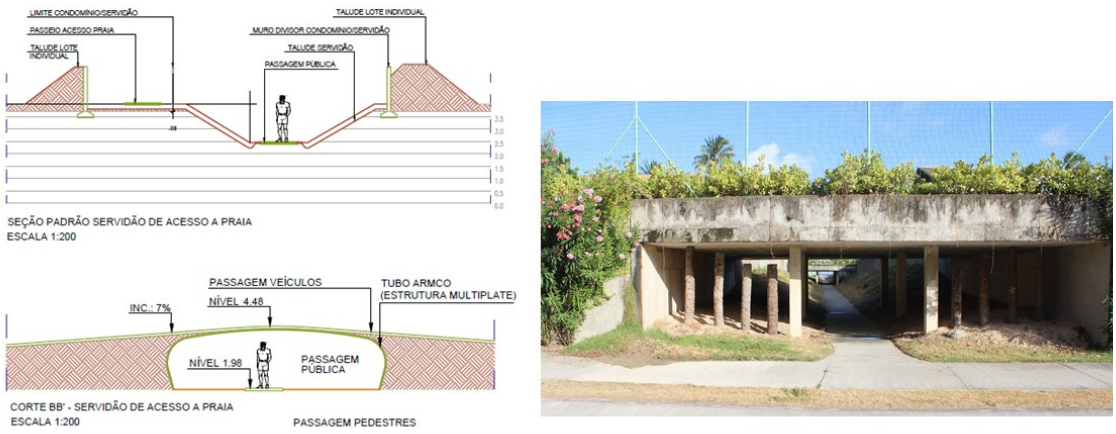

Figure 7: On the left, project of the servitude access route, source: Odebrecht, 2014. On the right photograph of the servitude access, second sector, peninsula dwelling. Source: author, 2018.

4 DISCUSSION

All these characteristics analysed by a morphological point of view, clarify self-segregation intentions of the enterprise. Reserva do Paiva is very far away from "a new way of life", or an eco-friendly design, it perpetrates the tradition of self-segregation centralities in Brazilian cities, just in a more megalomaniac way. This linear expansion of the well-to-do can illustrate an

extreme example of urban dynamics in Brazilian cities promoted by wealthier groups (Villaça, 2001). The enterprise cannot be characterized as a new central neighbourhood as it does not connect well to any neighbours. Connections to southern neighbourhoods are not facilitated by the new roads built at Reserva do Paiva coastal area.

Not only the spatial self-segregation is noted by this study, even some aspects part of the enterprise plan and its approval still do not function, bringing even less diversity of uses to this area, possibly impacting on even less chances of this ever becoming a centrality. The hotel that was in operation since 2014 closed its doors in 2020. The open mall and office buildings complex was finished in 2015, but never opened the doors.

The attempt to develop a *segregated centrality* is showing painful results, not only to visitors or pedestrians passing by, but to the developers. That said, Reserva do Paiva is expected to be fully develop in 2037 and some economic setbacks are not expected to stop these large kinds of development. The appropriation of important territories in a historical, economic and social ways is tradition of important Brazilian cities. In the other hand, this kind of development has been identified in various Latin American countries (Sposito 2013), as in African (Watson). This model takes advantage of developing markets, with deep inequality problems, in need of employment to present urban solutions in strategic locations. One possible alternative to balance it is through land legislation.

The clear and numeric results showing that this new street network does not facilitate integration, neither centrality could be used in other cases to make explicit actual topologic changes still on a design phase, thus helping refute discourses. Thus, this investigation demonstrates the validity to implement morphologic analysis in master plans legislation in response to early 20th century zoning methods. Syntax analysis offers powerful tools to a more thorough understanding of urban development and its polysemic nature. The syntactic analysis brought in this paper only emphasises this need, showing that even with a traditional approach, one can relate the direct consequences of a permissive legislation with urban pathologies.

Although the syntactic data and analysis procedures was exclusively from the axial map, the answers provided proved useful to characterize a large scale segregation. Nonetheless, it is worthwhile to implement other techniques used in recent researches to analyse more accurately other phenomenon details, such as: Angular Segment Analysis (ASA), Natural Street maps and Directional Distance model (Stavroulaki et al. 2017). Regarding similar cases, normalized integration and choice measures are indicated to analyse accessibility more precisely. Local street qualities, distances between uses and interfaces are also aspects to be further researched, especially after full implementation, as well as understanding how this relates with day-to-day mobility for people living and working there.

This paper finishes hoping to draw some attention to this model of urban development that Reserva do Paiva is an example of, and the will to open ways to study and develop more researches with syntax theory and methodologies, and urban form and mobility as a whole.

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