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## Revealing the spatial capital of everyday life of rehoused people

The case of Minha Casa Minha Vida housing programme in Natal, Brazil

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### ABSTRACT

This paper presents partial results of ongoing research that aims at revealing gains and losses in the spatial capital of everyday life of individuals who moved into housing estates financed by public housing programmes, as well as the possible effects of these gains and losses on social and urban issues. The spatial capital of everyday life is a theoretical-methodological effort created as an extension of the spatial capital theory (Marcus, 2010). This effort adds to Marcus's theory possibilities of measuring advantages for urban life from time-based accessibility to land use and configurational measures. To apply this effort to an empirical object, we measured the spatial capital of everyday life of people who moved into housing estates financed by the Minha Casa Minha Vida Housing Programme (MCMV) (“My House, My Life”), the largest housing programme that ever existed in Brazil. Spatial profiles were created from a combination of time-based accessibility measures extracted from unimodal and multimodal transport, land use, and information concerning private and public transport networks. The outcomes show that the beneficiaries of the MCMV with the lowest income suffer more disadvantages in terms of time-based accessibility to daily life support services and aspects of the network configuration, which may be engendering higher locational costs and deepening a process of socio-spatial segregation. These results indicate that the analytical approach is effective in calculating aspects related to access within the city, and can be an important ally to capture issues inherent to everyday life and to support decision-makers.



## KEYWORDS

Spatial Capital, Spatial Capital of Everyday Life, Housing Programmes, Minha Casa Minha Vida.

## 1 INTRODUCTION

This paper is part of an ongoing research that aims at revealing gains and losses in the spatial capital of everyday life of individuals who moved to housing estates financed by public housing programmes, as well as possible effects of these gains and losses on social and urban issues. The spatial capital of everyday life is a theoretical-methodological effort created as an extension of the spatial capital theory (Marcus, 2010). Basically, this effort adds to Marcus's theory possibilities of measuring advantages for urban life resulting from time-based accessibility to land use and configurational measures.

The Spatial Capital Theory (Marcus, 2010), deals with the social performativity of the urban form. Essentially, this theory addresses how different combinations of generic components of urban form (urban grid, plots, and building density), structured by urban design, can engender social, economic, and ecological advantages for the individuals, as well as for the sustainability of the spatial system itself. To obtain answers about this social performativity, the Spatial Capital Theory (Marcus, 2010) is supported by an analytical model (Marcus et al., 2017) that aggregates and converts information from the generic components of urban form into variables of distance, accessible diversity of plots, and accessible built density, which are directly associated to the potential of urban form to offer access to social and economic opportunities in the city. These conversions are done using the Place Syntax Tool (PST) (Stahle et al., 2005; Stahle, 2008). Place Syntax is a tool built from a unimodal transport network model that approximates the Space Syntax (Hillier; Hanson, 1984) to other more traditional approaches that investigate accessibility in a perspective of spatial ease of reaching different locations in the city, as proposed by Hansen (1959), for instance. For this, the PST works using location-based measures. I.e., instead of only calculating measurements from all points for all others, the PST also calculates metrical, topological, and angular access starting from different origins in the urban grid, which makes it possible to understand how advantages and disadvantages are distributed and available to a location, and for individuals living in or departing from that location. Therefore, the Spatial Capital (Marcus, 2010) is a theory about the ability of combinations of generic components of the urban form to promote advantageous locations, whether by enhancing market factors or improving urban and social life. An important approach to understanding timeless aspects of urban processes, evolution, and sustainability in cities that contributes to long-term planning and design.

However, despite the importance of this approach in understanding less changeable aspects of urban form and its effects on society, in order to understand the demands of everyday life, other layers such as time characteristics of displacement, accessible land use, as well as aspects



network settings must be considered. This is because dynamic contemporary life is based on the best use of time, especially in displacement times (Sheller; Urry, 2006; Sennett, 2018). Therefore, as facilities related to land use and aspects related to the network centrality are more available around certain locations, people who live there tend to spend less time commuting to access social and economic benefits, and consequently have more advantages for everyday life (Cervero et al., 2017; Barton et al. 2021; Pereira, 2018; Moreno, 2021).

In this scenario, the problem is that a vast range of studies provides evidence that the time-based accessibility to opportunities and facilities, tends to be related to people's income (Harvey, 1980; Villaça, 2001; Lucas, 2012; Suárez; Delgado, 2007; Suárez et al., 2016; Lucas et al., 2016; Pereira, 2018; Pereira et al., 2019). Lower-income individuals tend to have fewer spatial advantages at their disposal, thus they need to travel long distances to reach all kinds of locations, uses or services. This happens both because of the lack of services that support daily life in their surroundings, and because they are in a region of the city that is less connected to central areas due to the urban design itself and/or the public transport system. Low access to the city ends up generating other problems for the poorest, such as additional financial and psychological stress (Harvey, 1980; Lucas, 2012; Lucas et al., 2016). In this context, public policies created to reverse or stabilise socio-spatial inequalities, such as housing policies, should be created in order to mitigate this situation, promoting an accessible city with all it entails (Harvey, 1980). With the intention of deepening this discussion in the Brazilian context, we investigate the spatial capital of everyday life of individuals who moved into housing estates financed by the Minha Casa, Minha Vida (MCMV) (“My House, My Life”) housing programme, addressing the housing estates financed and built in Natal, capital of Rio Grande do Norte, Brazil. The MCMV was a major housing programme that during its existence, between 2009 and 2020, financed the acquisition of almost 4 million housing units (H.U.) nationwide for low and medium-income people. In Natal, most MCMV housing estates were built in peripheral unoccupied or poorly occupied areas, hence expanding the city occupation, and forming new relationships among the people who moved into these new areas. In this regard, the following research questions arise: how is the spatial capital of everyday life in the MCMV’s housing estate? Is the spatial capital of everyday life useful to understand everyday urban problems? Our hypothesis is that the housing estates built for low-income individuals are located in areas with a lower level of spatial capital of everyday life on the local scale than those built for middle-income individuals. Thus, people with lower income need to travel longer distances to access opportunities in the city. Traveling longer distances makes them more dependent on paid modes of transport, creating social and urban problems. Spatial capital profiles were created taking into account accessible spaces in different radii for each location. These profiles were built with the support of a unimodal and a multi-modal urban transport network created with information about the land use, the private and public transport system network. At last, the constructed profiles were compared to understand how the housing estates relate to the city at various scales.



To detail what was briefly presented in this introduction, this work is divided into a topic that presents the concept of Spatial Capital of Everyday Life, followed by another that explains the Minha Casa, Minha Vida housing programme, a methodology section, the results, and finally a brief discussion of these results.

## 2 THE SPATIAL CAPITAL OF EVERYDAY LIFE

The concept of spatial capital of everyday life proposed in this paper is an extension of the theory of Spatial Capital developed by Lars Marcus (2010). The Spatial Capital itself extends Space Syntax (Hillier; Hanson, 1984) and broadens the understanding of the social performativity of the urban form, taking into account more elements and aspects of urban morphology, in addition to the classical approach of the Space Syntax. More precisely, Marcus's theory addresses the fundamental value of land beyond the investments in fixed capital in space (roads, infrastructure, and buildings) but as a product of urban design. It seeks to ascertain how different combinations of the generic components of the urban form (urban grid, plots, and buildings) can engender social, economic, and ecological advantages for the individuals, as well as for the sustainability of the spatial system itself.

In a wider context, the theory of Space Capital (Marcus, 2010) fits into what Lin (2002) classifies as neo-capitalist theories. These are theories created to refine and apply the classic meaning of capital - the investment made in something or someone with an expectation of return for those who make it - in diverse areas of knowledge, pulling away from the Marxian explanation of class conflict and bringing the concept closer to the individual as a social being within the centre of the conflict. Marcus (2010) brings this approach to the studies of urban space, by focusing on the investment that is made in urban design in order to create possibilities and restrictions that can be decoded into spatial advantages or disadvantages for individuals as social beings in the sense of creating social connections.

An analytical model (Marcus et al., 2017) of spatial urban form supports the theory. This model seeks to provide answers about how the combination of generic components of urban form (urban grid, plots, buildings) structures aspects of distance, diversity, and density in the city. The analysis of these variables is based on a location-based approach, differing from the classical place-based approach of Space Syntax. In other words, instead of processing measurements from all points to all others in the spatial system, as occurs in the space syntax methodology, this model proposes analyses from a certain origin, i.e., what is possible to achieve in terms of spatial variables from a certain origin in the city.

The analysis was performed using the Place Syntax Tool (PST) (Stahle et al., 2005; Stahle, 2008), a tool derived from the Place Syntax methodology (Stahle et al., 2005; Stahle, 2008), which processes information about the urban grid from the axial map and its derivatives, plots, and built area, transforming them into results of metric, topological or angular accessibility to diversities



of plots and density of floor space. According to the authors (Marcus et al., 2017), this accessible density and diversity are directly related to the spatial capacity to "stack" different people, things, and land use. Characteristic intrinsically related to the potential of space to offer access to social and economic opportunities in the city.

However, despite theoretical and methodological contribution of the theory of Space Capital, we argue that the approach can be extended to include more elements that could tailor it further to specific contexts, such as understanding everyday life in cities. For this reason, we propose an extension we call the Spatial Capital of Everyday Life. A dimension that focuses on aspects more related to people's daily lives, as the time-based dimension of access to opportunities to reach certain places that support daily life (such as schools, health facilities, markets and shopping, leisure areas, and public services), centralities, and spaces with potential of encounter and movement at different scales in the city.

In practical terms we are calculating what is possible to access/reach in terms of connectivity, integration and land uses to support everyday life using different modes of transport - walking, cycling, and public transport - at different travel times. These reach/accessibility measures are calculated using unimodal and multimodal urban transport networks, built from a combination of land use, private transport network and public transport network information.

The components of the spatial capital of everyday life (connectivity, integration, land use), in turn, were chosen due to connectivity is an important indicator of urban grid density and ease of movement at the local scale (Cervero; Duncan, 2003; Dill, 2004; Ewing; Cervero, 2010; Zhao, 2014; Kooshari et al., 2016); the integration measure is an important indicator of centrality, potential for encounter and movement in the urban grid; and the presence of uses that support the everyday life in the surroundings of a given location is a stimulating factor for the presence of people on the street, interpersonal encounters, shorter trips, less use of non-motorized transport and better quality of urban life (Cervero; Duncan, 2003; Ewing and Cervero, 2010; Netto et al., 2012; Netto, 2017; Cervero et al., 2017). By measuring this, we are measuring how the city supports individual everyday life at different scales. The presence or absence of this support, in turn, is related to advantages or disadvantages regarding equity of access, right to the city, and quality of urban life.

### **3 THE '*MINHA CASA MINHA VIDA*'**

Several studies relate locational advantages (seen as to ease of access in the city) with income and social status (Harvey, 1980; Villaça, 2001), drawing attention to a relationship between income level and locational advantages. While people with greater purchasing power have the possibility to choose their locations in the city and the locational advantages they want to have, others end up being distributed through residual spaces. Researchers such as Villaça (2001), Gomide (2003), Pereira et al. (2019) attest that locational advantages linked to income is an



everlasting, pervasive characteristic of Brazilian cities. Whereas people with greater purchasing power reside in spaces that are well served by services for everyday life, people with less purchasing power need to travel greater distances to reach these services. The uneven distribution of spatial capital from everyday life in this kind of city remains despite the public policies created to reverse or stabilise socio-spatial inequalities, such as housing policies, that do not seem adequate to mitigate this situation. The MCMV, created in 2009 and discontinued in 2020, was the larger public housing policy that ever existed in Brazil. During its existence, the MCMV financed the acquisition of almost 4 million flats/housing units nationwide for low and medium-income people. In Natal, a city of one million people in northeastern Brazil, our empirical focus, the MCMV housing programme financed around 8,000 housing units (HU) across the city. Of these, about 2600 HU were intended for low-income people, while 5,000 HU for middle-income people were distributed in about 164 housing estates. We have obtained information on the location of 61 of the 164 housing projects, as shown in Figure 1.

The MCMV financed the construction of these new housing estates in unoccupied or poorly occupied areas of Natal, contributing to consolidate a pattern of sparse, patchwork-like occupation, and the sprawling form of city expansion. In this scenario, we may ask: what is the spatial capital of everyday life like in the MCMV's housing estates?

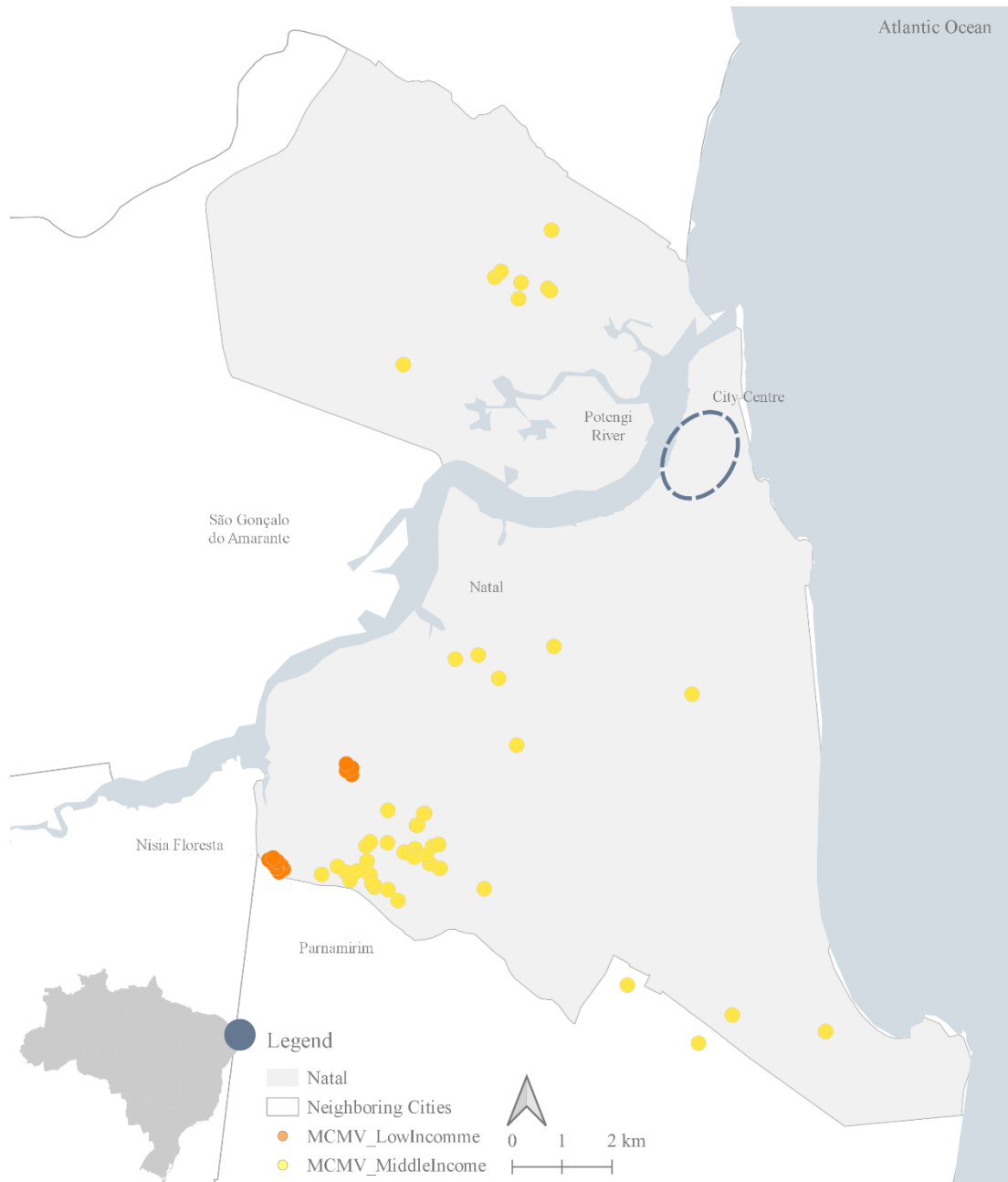


Figure 1: Location of the Minha Casa Minha Vida Housing Estates in Natal, Northeast Brazil.

#### 4 DATASETS AND METHODS

To answer these questions, we have built an analysis based on what we are terming as profiles of spatial capital of everyday life regarding the location of the MCMV's housing estates. The definition of these profiles was rooted on location-based or "reach" measures in local and global radii considering different travel times for different modes of transport: 10-minute walking, 10-minute cycling, 23.5-minute and 47-minute of public transport<sup>1</sup>. For each profile we took into account the components of the spatial capital of everyday life that are necessary to sustain

<sup>1</sup> These travel times were defined from the results of the National Public Transport Association (ANTP, 2018) report.





everyday life and represent spatial advantages at each scale. For the local scales (walking and cycling trips), navigability aspects such as connectivity and integration of the network, and access to services that support daily life (schools, health clinics, markets, shopping, leisure places, etc.) were considered. To understand the spatial capital of everyday life on a global scale (public transport journeys), we investigated access to support services and network integration. To build these profiles we created a unimodal and a multi-modal urban transport network models, concerning the local or the global scale. Both were built based on information about origins, destinations, the urban grid, and the public transport network. Achieving this, the city was divided into hexagons, extracted from the Uber H3 database<sup>2</sup> (resolution 8: 0.74 km<sup>2</sup>, 357 meters on the shortest diagonal). Then, the land uses (housing estates, and services to support daily life<sup>3</sup>) were spatialized and their information linked to the centroid of each hexagon (Figure 2). These centroids turned out to be the origins and destinations in the model. For the local scales, the link between these origins and destinations was constructed from the segment map, processed from the axial map (Figure 2). For global scales, the links were built from the segment map connected to the public transport network (Figure 3). Origins, destinations, and both type of link between them turning into directional graphs. To build spatial capital profiles of everyday life based on travel times, the segment map as well as the public transport network were transformed into street junction maps (MARSHALL et al., 2018), in which the intersections between them are the nodes of the graphs and the extension of the segment / of the travel segment are the vertices. Source and destination nodes were also added to these graphs. After construction, the graphs were processed in order to answer which nodes were reachable from a certain origin in a certain travel time. Origins, destinations, and both types of links between them turn into graphs. To build spatial capital profiles of everyday life based on travel times, the segment map, as well as the public transport network, were transformed into street junction maps (MARSHALL et al., 2018), in which the intersections between them are the nodes of the graphs and the extension of the segment / the travel segment are the vertices. Source and destination nodes were also added to these graphs. After construction in the QGIS, the graphs were processed in python, within the networkX library, in order to answer which nodes were reachable from a certain origin in a certain travel time.

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<sup>2</sup> The initial intention of this work was to use the geographical reference of urban plots as origins for the spatial analysis. This would improve the resolution of the analysis and avoid the modifiable areal unit problem (MAUP). An issue that can affect the results of spatial analyzes based on aggregated data to areas artificially demarcated such as census sectors and grids, given the sensitivity of spatial data to scale changes (Wong, 1991). However, the database of plots in the city of Natal/RN was incomplete, not including plots from areas where there is a high concentration of housing estates financed by MCMV. Therefore, the choice of hexagons was made for three main reasons: The first is that the proposal presented here is not defined by the use of hexagons, it can be replicated from urban plots and blocks; the second reason is that because the Uber h3 is an open-source database that covers the entire surface of the globe, opening the possibility of the methodology being replicated in other places with the same limitations to data access that this work had; the third reason is that this same database, with the same resolution, was used in studies such as Pereira et al. (2019) and Pereira et al. (2021) who measured access to opportunities in Brazilian cities and the results were robust and satisfactory, which indicated that this thesis would follow in the same direction. For future work, it is expected that other sizes of hexagons can be tested in order to compare them in a sensitivity analysis.

<sup>3</sup> The housing estate data were provided by the Federal Government. Information on schools and health facilities was extracted from national databases. Information on other uses was obtained from the Google Maps database.

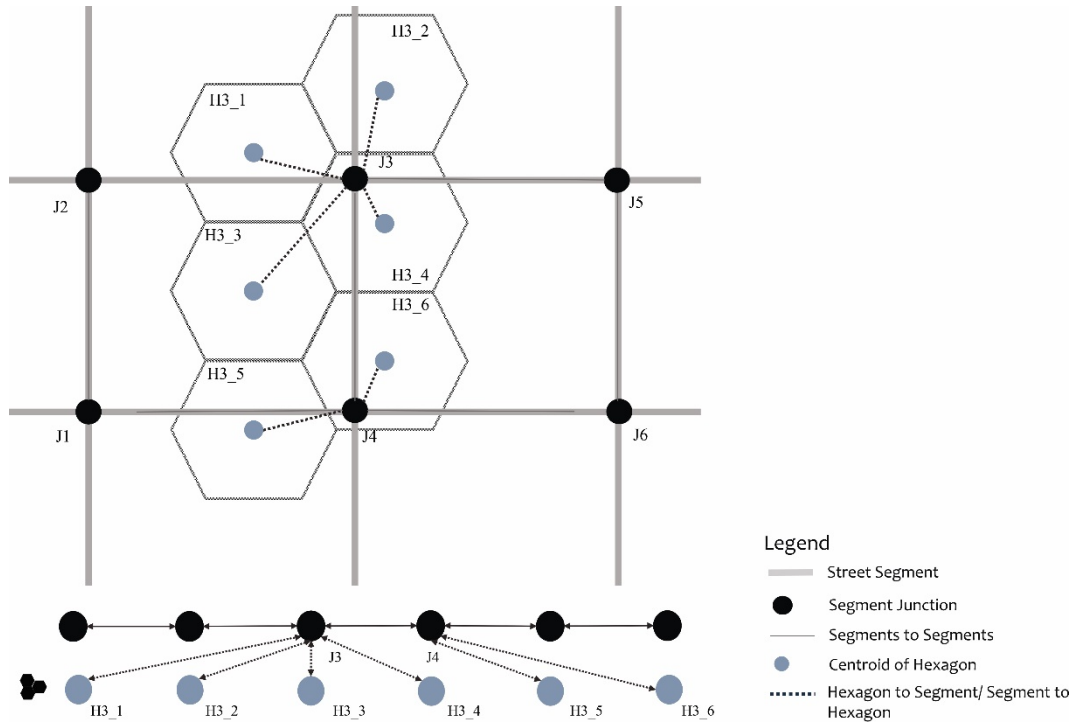


Figure 2: Scheme of the unimodal urban transport network for local analysis.

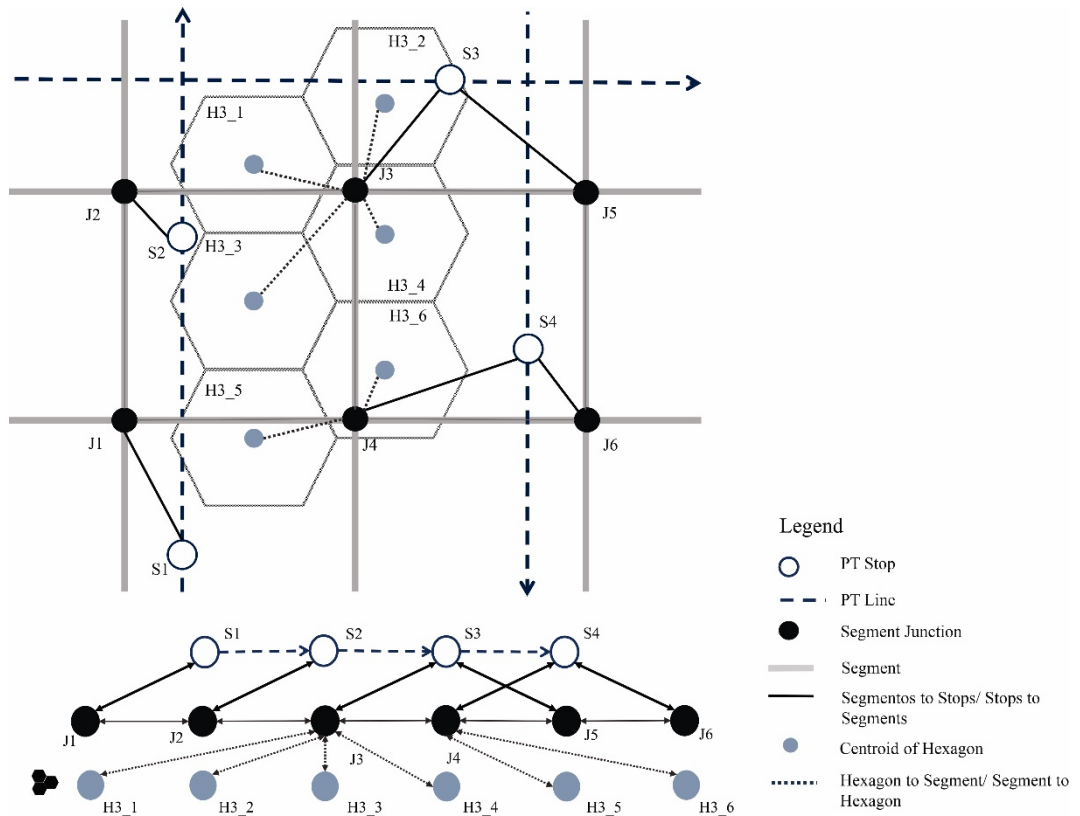


Figure 3: Scheme of the multi-modal urban transport network for global analysis (including public transport network)



Then the results of the different spatial capital components were grouped into 03 k-means clusters: profiles with higher spatial capital of everyday life, average profiles, and profiles with low spatial capital of everyday life.

## 5 RESULTS

This section presents the profile of the spatial capital of everyday life for each origin in the city, focusing on the study case, i.e. the locations of the housing estates financed by the MCMV housing programme. These results are divided into three parts, each one related to different modes of transport (walking, cycling, public transport) and travel times. The walking scale outcomes, i.e., the components of the spatial capital of everyday life possible to achieve from a 10-minute walk from an origin, show that low-income individuals rehoused to the MCMV housing estates have a lower level of this spatial capital compared to the vast majority of other origins in the city, as shown in Figure 4 in the charts in Figure 5. This lower level of spatial capital on this scale is evidenced by the low access to support services, especially public services such as schools and health facilities. These low-income individuals are also disadvantaged in the cycling scale, as shown in Figure 4 and in the charts in Figure 5. That is, in a 10-minute bike ride, they can still access a lower level of components of the space capital of everyday life compared to other areas of Natal. In this case, different from the walking scale, these people have better access to support services and areas with better integration in the city; however, compared to other areas of the city, this level is still lower. The lower access to components of the spatial capital of everyday life for the low-income individuals compared with the city is also found in both scales of public transport journeys (23.5- minutes scale, and 47-minute scale). In this mode of transport, access is worse on shorter trips, which means they have to travel long distances to have the same level of spatial capital of other areas more privileged in the city. Regarding the housing estates built for middle-income people, in general, they have better spatial capital of everyday life profiles than those built for low-income people, and median profiles if we compared to the city at all scales, such as shown in Figures 4 and 5. The highlight is the decrease in the level of space capital on the scale of the 24-minute public transport travel, which may indicate that there is no overlap between the transport network available to these locations and the location of services that support daily life.

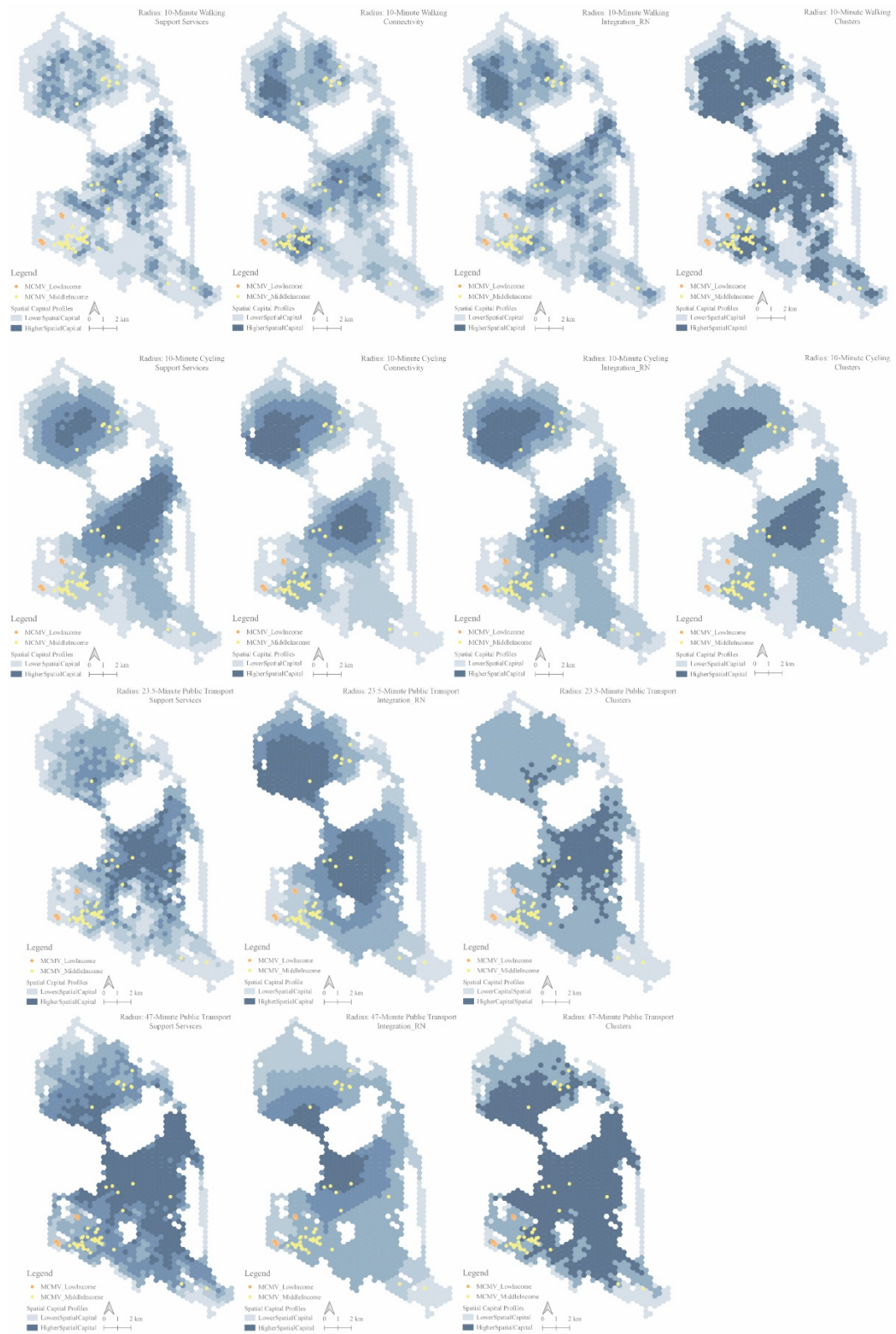


Figure 4: The spatial capital of everyday life of each hexagon by scale. Line 1: 10-minute walking scale. Line 2: 10-minute cycling scale. Line 3: 23.5-minute public transport scale. Line 4: 47-minute public transport scale.

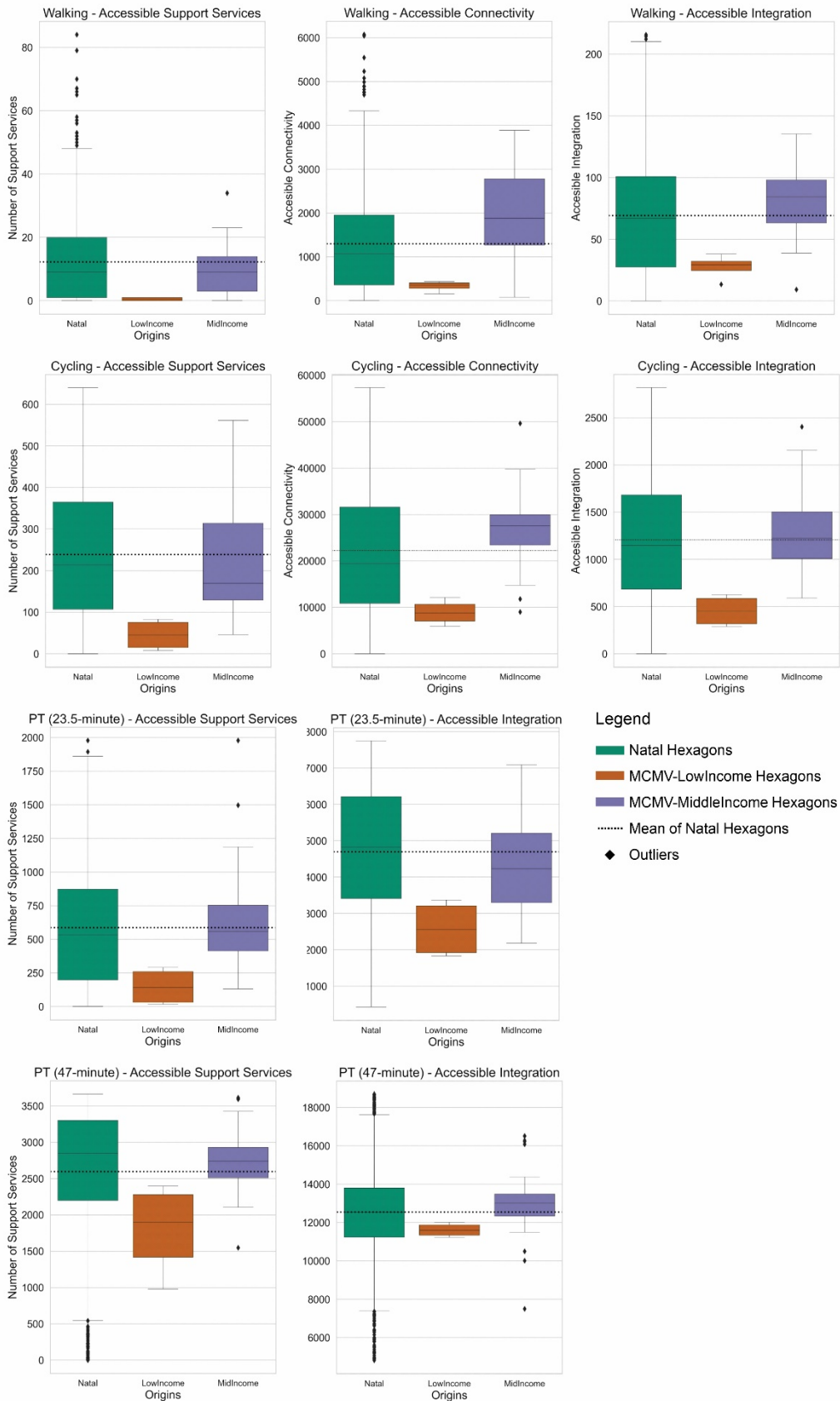


Figure 5: Comparative graphs among the spatial capital of everyday life of the low-income housing estates (orange boxes), middle-income housing estates (purple boxes) and the whole city (green boxes). Line 1: 10- minute walking scale. Line 2: 10-minute cycling scale. Line 3: 23.5-minute public transport scale. Line 4: 47- minute public transport scale.



## 6 DISCUSSION AND CONCLUSIONS

In this paper, we have sought to introduce the concept of Spatial Capital of Everyday Life as an extension of the theory of Spatial Capital (Marcus, 2010). This extension adds a time-based perspective to the current pool of methods in order to understand how services and locations can be accessed by daily routines and by whom, considering unimodal and multi-modal transport networks, thus investigating, albeit indirectly, the urban life of individuals. This framework was applied to a case study in which we measured the everyday life spatial capital of residents in the housing estates financed by Minha Casa, Minha Vida (MCMV), the largest housing programme that ever existed in Brazil. The results confirm the initial hypothesis that the MCMV housing estates built for low-income individuals are located in areas where the level of spatial capital of everyday life is lower than those of MCMV housing estates built for middle-income individuals. Therefore, the MCMV reproduces the logic of an unequal city for people with different incomes, where higher-income individuals are better served by the spatial capital of everyday life than those with lower incomes. This fact increases urban problems, mainly because low-income people depend more on the structure of physical space and the availability and efficiency of public services for the development of their everyday life (Marques, 2017). Thus, when access to the city is impaired, especially at local scales, low-income families have additional location costs, such as costs of having to pay for public transport fares or individual transport fuel; time costs of having to spend more time on daily trips; and emotional, psychological and limited freedom of choice costs for individuals (Harvey, 1980; Lucas, 2012; Lucas et al. 2016). It recalls the need to discuss and remodel urban policies and programmes, taking into account the daily needs of those for whom these policies/programmes are intended. These results point out how important it is to understand issues that are intrinsic to daily urban needs as well as the problems arising from them. This indicates that the concepts and analytical procedures proposed here, despite limitations still being addressed, are a first step towards the inclusion of such issues in the scope of the spatial capital theory (Marcus, 2010) and could be an important tool to measure the impact of location on daily life, which can help devising solutions to these problems, through decision-making actions and better urban design planning. Furthermore, the concept of spatial capital of everyday life and the proposed method to measure it can advance the ambit of findings in studies concerning relationships, overlaps and combinations of aspects, thus helping to unravel the complex urban system and its relations with social problems.

For future developments, it is expected that the concept and method will be tested and refined in order to overcome limitations such as the MAUP issue, as well as to narrow definitions concerning components and the measures of each component that are needed at each urban scale to better support people's daily life.

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