

SPATIAL AND POLITICAL ASPECTS OF LOCATION IN THE GRID:*the case of Belem in Brazil*

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0 Abstract

The paper presents some preliminary results of a study using space syntax techniques to identify relationships between spatial characteristics of the grid of Belem over the last five decades and location valorisation as it appears in the cadastral map of the city.

Key words: Brazilian cities, cadastral system, location valorisation.

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Location valorisation for taxation purposes in the Brazilian local government finance and planning system is assessed according to market value and politically based decisions about infrastructure provision. The paper presents evidence from comparisons between degrees of intelligibility and patterns of values distribution showing that the grid form is an important factor in the establishment of value.

The paper puts special emphasis on the form of the peripheral housing estates of the city to illustrate how location can be related to revenue raising and expenditure decisions taken by local government.

1 Introduction

The political importance of location has been associated with the question of social equity in cities of developing countries. The achievement of equity presupposes the fair provision and maintenance of services by the state in different locations of the city. Equity in infrastructure provision can create opportunities to 'equal access to basic social needs, to employment and reasonable living conditions regardless of income or location' (Davey and Devas, 1996: 195). In this paper, the political importance of public funds and their distribution through the fiscal system is analysed through the issue of the location of housing developments on the periphery of Belem.

Decisions about the implementation of services, which could provide of equity and opportunities in the city, are considered a main political factor in developing countries, where different social groups interfere in the decision-making process. In Brazil, social inequity in urban areas is characterised by great differentiation in the location of social groups in the city. Spatial differentiation of dwelling types, themselves a mark of social ranking, is visibly associated with the level of services provided by local government. The provision of services in areas of high-valued locations of high-rise buildings, for example, is considerably greater than in those occupied by low-income dwellers. Administratively, existing patterns of location valorisation are a main element in the assessment of the revenue and expenditure performance of the city (Dowal and Leaf, 1997). All households pay taxes assessed in part according to a very broad valorisation of the location of the property (related to existing infrastructure) and valuation of the buildings (dependent on market value and the characteristics of the buildings and the land, including their uses).

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For the purposes of this study, locations valorisations were taken from fiscal information of Belem local government and compared with spatial relationships in the grid, using space syntax techniques. Basic spatial concepts such as the potential for movement within the urban grid were considered in the rationale for the study; this and other requirements form part of the demands of poorer classes, struggling for improvement of their living conditions. The study proposes a re-interpretation of the pattern of value distribution on the grid. It aims to contribute to urban politics with spatial information which goes beyond land use determinism as it is presented in social theories of urban structure (Castells, 1977).

The study aims to establish a correspondence between spatial characteristics of the grid in Belem and land values, as they were used by the city governance. For this purpose, the paper enquires if social differentiation in the grid, expressed by different valuations of plot frontages, is a consequence of the degree of intelligibility of a location within the urban grid. The paper also discusses whether opportunities for physical access from the periphery to the city centre are a mere physical consequence of the city space configuration or a result of the pattern of peripheral developments (Dekel, 1997). The paper finishes with a discussion of whether physical segregation can be associated with morphological features of peripheral locations occupied by diverse social groups on the periphery and of the possible role of the state in decreasing the degree of segregation.

2 The Brazilian fiscal system and the city

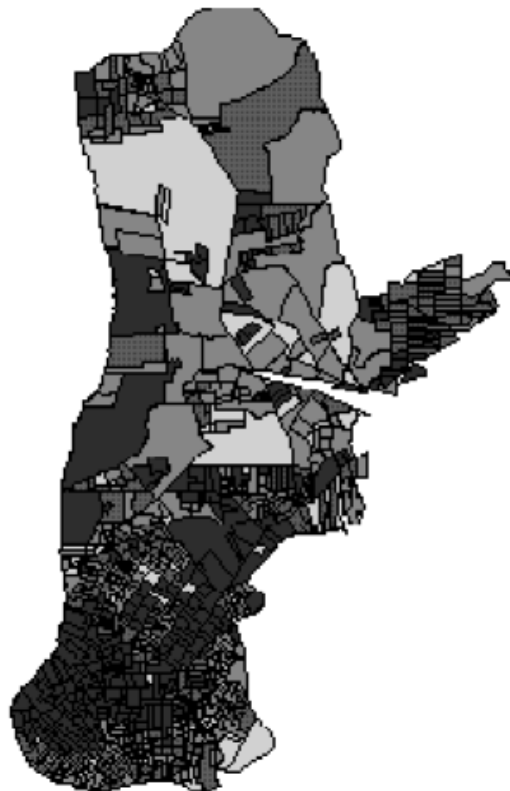
2.1 Land values for the assessment of property taxation

In Brazil, location plays an important role in the assessment of property taxation (Urban Territory and Property Tax). The calculation of property taxes relies on three main factors which are interrelated: valuation of the property (of a plot or for a building and its plot), location of the property in the city, its use and whether the property is owned or rented. On cadastral maps of the cities, local government registers show which streets are provided with which services (see figs. in section 4.1 below). The number of existing services on a block frontage, and approximate market values of property in given streets, are indicated by a number placed alongside the alignment of the blocks along a street. Another component of the property tax is related to the nature of its occupancy: residential, business, etc. There are also different rates for each land use and for the state of maintenance of each building.

The values assessed for each block frontage¹ are found in cadastral maps and constitute one part of the calculation of property tax to be paid for each property. These values derive from indexing roads according to existing infrastructure and other features. The distribution of values in the cadastral maps illustrates the pattern of service delivery as it has developed in the process of urbanisation of Brazilian cities; each frontage is indexed according to the existence of road paving, water supply, drainage, sewage, and garbage collection. It acts as an indicator of the distribution and delivery of different urban services. Besides considering a road's location in the overall city structure, the calculation as noted above combines other indexes such as tenure, size of property and built floor area and use.

Property taxes are calculated in ‘municipal fiscal units’, and each fiscal unit corresponds to a certain amount of currency. A municipal law approved by city councilors every year establishes such correspondence and all other valorisation procedures. Every year the local administration must conduct a survey to assess how the market is behaving, something artificially assigned, but it is important to note that final decisions are approved by local councillors. All the information and calculation procedures are available to the public in the finance secretary’s office, but each city has a different system, and every city has a different procedure for calculation while following the same national revenue principles. Variations in the valorisation of streets show that consideration is given to a timelag in imposition of the tax; rates can increase according to the time passed after the service has been provided.

Frontage values are not purely a valuation of the location or of the property itself, but are also an indication of how a location value is affected by political decisions. The cadastral map with its frontage values provides the basis for the system of valorisation and taxation assessment. The values vary street by street, showing that for the same development with various facades, there are differences in valorisation, dependent on the location of the street. The figures appearing in fiscal units in the cadastral map of Belem are expressions of property values as assessed by the fiscal system. In this research, they were used to analyse how far priorities for locating services in the overall city grid were decided upon political lines.



2.2 Belem

Belém, the capital of Par· State, lies on the fringe of the Amazon region, and is the largest capital city of the Brazilian Amazon, with a population of about 1,200,000 (COGEP, 1992). It occupies an area of 13,000 hectares at the intersection of the Par· (a tributary of the great Amazon River) and Guam· rivers, on a Bay called Guajar·. The city exemplifies the features of Amazon topography, particularly in the neighbourhoods with a river frontage.

figure 1. Map of Belem showing levels of income according to the census. Source: IBGE, 1991.

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figure 2a. Axial map of Belem - 1950
Source: EBTU, 1980; CODEM, 1977

figure 2b. Axial map of Belem - 1979
Source: CODEM, 1986.

figure 2c. Axial map of Belem - 1995
showing the city core and a portion of
the periphery. Sources: CODEM, 1986;
COGEP, 1991.

The spatial distribution of social groups in the city clearly shows how the most privileged spaces occupy the city main core (Fig. 1). The periphery, on the other hand, presents a sort of 'patchwork' development where prestigious locations are clustered next door to social housing estates. The social mix found in the occupation of the periphery is the focus of urban development studies of the role of government policies in the management of urban areas, assessed according to equity objectives (Devas and Rakodi, 1993).

The maps of the city showed how the initial grid of 1950 was developed, and how the formation of the periphery occurred. Piecemeal development from the 1960s started to alter the logic of the initial formal grid of the previous decades, as can be seen in the 1979 map (Fig. 2). Following occupation of the areas immediately surrounding the most urbanised core, housing estates were located beyond them on the margins of the former rail axes, which became axes for urban expansion. The pattern of occupation of those areas is seen in the 1979 map.

The categorisation of open spaces according to convexity and segregation patterns over the last six decades displays the tendency for fragmented housing estates to be located beyond the city's original core. Different patterns of grid development were substituted for the original grid of the city until 1980. Massive urban sprawl took place from the 1970s, and because of land occupancy by institutions with large land holdings, this sprawl was separated from the main core of initial urbanisation. The resulting grid began to be related to the main axes, and not to the more compact structure seen in the original grid.

The occupations of the last decade on the periphery can be described as creating a hierarchical occupation (Alexander, 1965) marked by a main road link from where the developments are linked, producing a haphazard aggregation of housing estates and land invasions. The level of physical segregation was worsened by the construction of fenced condominiums, replacing the pattern dictated by the housing choices of the 1970s and 1980s, as middle class people chose a condominium rather a centrally located flat.

The location of low-rise housing estates on the periphery of cities was common in Brazil during the 1960s and 1970s. In the 1980s, Brazilian cities with their growing populations started to present housing deficits, which became qualitatively acute in conjunction with an infrastructure crisis, especially in sanitation, despite all efforts to address the failure of housing policies the decades also the emergence of illegal settlements. Few studies have attempted to search for spatial causes involved in that failure (Souza, 1992). The spatial pattern of the city as a whole needs therefore to be analysed, especially in relation to the consequences of the conflict between local government and national housing policies upon the formation of urban peripheries. National policies did not take into consideration the peculiarities of growth patterns on the peripheries of the cities, causing housing estates to become large, fragmented urban extensions, which nevertheless needed to be managed and incorporated into the city.

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3 Methodology

Axial maps of Belem were drawn from different sources (CODEM, 1977, 1986, 1995; PMB, 1980) and were used to trace the evolution of the city in 1950, 1963, 1979 and 1995 (Fig. 2a, b, c). The axial map of 1995 was also used as a platform for inserting location values of frontages as they appear in the only available cadastral map of the city, that valid from 1985 to 1998.

Fragmentation of streets patterns between the main core and the periphery, made up of clustered estates with few links to the surrounding areas, brought problems in analysing the overall city. The overall grid presented the 'edge effect' (Dalton and Vaughan, 1997). After processing all the lines of the axial map of 1995, the line with the highest integration value in radius infinity was found to be the main link between the main core of the city and the periphery. In order to avoid concentration on that, the overall grid was analysed in separated parts.

The city was divided into two portions (figs. 2c). The boundaries of the main city core were set by the area comprised by the main centre of the city in 1950. Extensions to the original grid of the city before the occupation of low income areas were outside its boundaries. A second portion was comprised of recent occupations in the 1980s by extensive social housing estates (around 1.000 plots provided in each scheme) and fenced condominiums.

First the main core of the city was analysed and then parts of the periphery were selected with the distribution of frontage values obtained from the cadastral map of Belem noted for them. When inserting frontage values as individual observations, some difficulties had to be overcome: for Belem, valorisation is assigned block by block while Axman (Dalton and Vaughan, 1997) gives unique values to each axial

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line. The axial lines were used for Belem but there were different values along them. In some areas, the same road had different values along it because the amount of infrastructure varied along it. The solution adopted was to use the predominant value.

The statistical tests routine described in Axman were used to show correlations between fiscal values and integration into the city. Portions of the 1995 map were separately analysed. Parts of the periphery with housing estates were compared with the grid of the centre and were analysed. The analysis showed the spatial characteristics of the grid affecting the distribution of socio-economic differentiated groups in the city.

4 Analysis

4.1 Spatial logic in frontage valorisation

Spatial characterisations of the grid of the main city core and of the periphery were compared with frontage values in order to explore a spatial logic in frontage valorisation. The separation of the city core and the periphery was made because, when processing the whole 1995 axial map, the clear separation between the city core and the periphery exacerbated the edge effect.

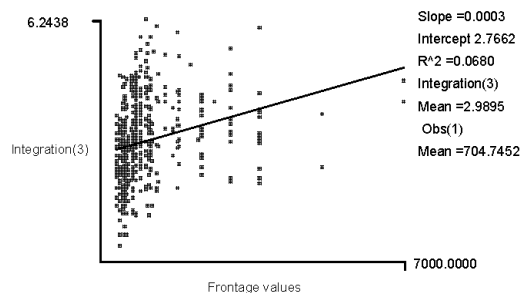
In the city core, values range from 100 fiscal units to a maximum of 7.000 units. On the periphery, condominiums have the same maximum value as the road in front of their gates (301 units) and public housing value range from 80 units to 100 units (Fig. 3b).



figure 3a. City main core - Local integration

figure 3b. City main core - Frontage values distribution

figure 3c. Scatter showing the relationship between local integration and frontage valorisations in the city main core



The correlation between local integration and frontage value distribution in the city core showed how important the configuration of the grid was to the provision of infrastructure for the most prestigious locations. The scattergram in figure 3c shows the correspondence between local integration and frontage values. It was found that values in the city main core were higher because, historically, sites there had the advantage of a constant provision of infrastructure in a highly integrated grid that resembles cities in the countries of the developed world. The correlation between local integration and frontage values in the city core is representative of the closeness of that built area on a compact scale. The distribution of values in the map of the city reflects the degree of global integration when the city did not have a peripheral sprawl, as seen nowadays.

Neither locally nor globally can the occupation of the periphery be described by a linear function, as in the grid of the main city core. Figure 3c shows the result of plotting frontage values and the degree of global integration of spaces on the periphery. The search for reasons for the differences address morphological features of the periphery in contrast to the city core. Spatial aspects of location were useful in analysing how the morphological features of housing developments contributed as an important factor into social separation.

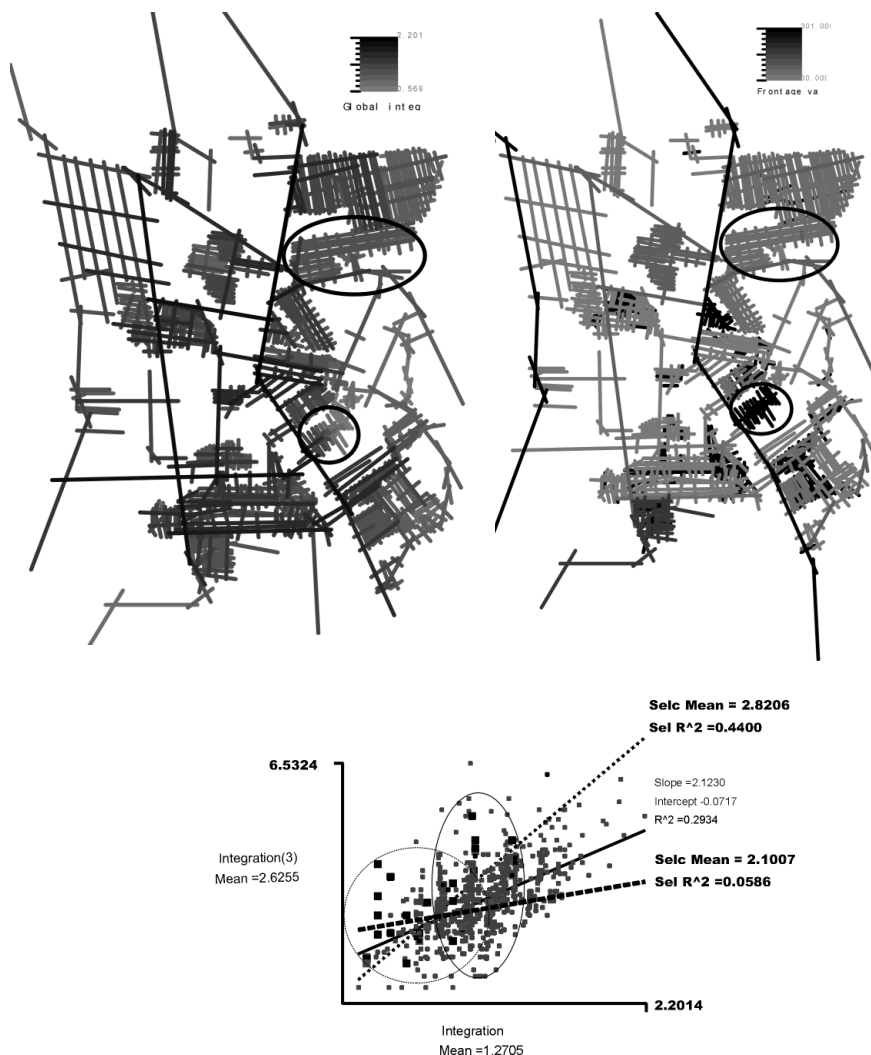


figure 4a. Periphery of Belem, Global integration

figure 4b. Periphery of Belem, Frontage values distribution

figure 4c. Scattergram showing the intelligibility of the overall peripheral area selected (correlation in solid lines), the position of social housing (correlation in dotted line) and of condominium (correlation in bold dotted line).

4.2 Clustered layouts and segregation

Physical segregation in the context of peripheral development in Brazilian cities is perceived as a negative factor because it causes constraints on the provision of public services such as public transport and the extension of services networks. A first question, which arose in the analysis of frontage values of the periphery, was whether location, layout of the developments or both could associate physical segregation with neglected provision of infrastructure in government policies.

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Comparisons between intelligibility of the periphery and of the housing developments showed that not only was the difference in location important in understanding social segregation, but also in understanding the integration or otherwise of layouts. Social housing estates and condominiums are segregated from the rest of the city not because of their single access to a main road link, but because of the overall grid structure combined with their internal layouts.

The internal configuration of social housing estates appears, for the intelligibility of the periphery, to be more favourable overall than the configuration of condominiums. Figure 4c shows a scatter of periphery intelligibility with enhanced lines of social housing and condominiums. The degree of integration noted in the internal layout of social housing schemes does not present lower values as in condominiums (Fig. 4a - note darker areas at the deepest part of the condominiums layout). This seems to be caused both by the existence of different accesses and by the location of social housing and open spaces at the edge of the social housing layouts.

In condominiums, both their internal configurations and the control points at their entrances were considered responsible for their desired and designed physical segregation. Control points at their entrances are responsible for a control of movement flow. The organisation of their internal grids relies on global integration through the axis linking the city and the periphery. Inside the condominiums, movement is limited by their shallow internal integration due to their layout configuration. Besides that, the projects of condominiums do not take into consideration the creation of spaces for social contact.

5 Preliminary conclusions - means of segregating the city

Housing estates on Belem's periphery were used as case studies, in order to discuss in detail how decisions on location of housing estates influenced the relationship between the main core of the city and the formation of the periphery. Emphasis on housing estates on the periphery enables understanding of the extent to which their location and configuration could facilitate a better fiscal performance of the city.

The relationship between the dynamism of city growth and the morphologies produced by the state through its housing policies on the peripheries demonstrates that hierarchical form of the periphery plays an important role in the failure of infrastructure provision policies. The initial social housing projects did not include services, which nevertheless need to be provided when the estates become part of the overall urban grid. Problems lie in the trends of infrastructure provision, frequently arising from housing policies. Infrastructure provision is not clearly understood with its relationship to the overall spatial pattern of the city by local government actions.

Therefore the effectiveness which social housing could have in facilitating the aggregation of the built form is limited, because of the failure by the city authorities to provide services where needed.

In the case of Belem, physical segregation was firstly associated with the spatial logic of values which follow politically based decisions about the provision of infrastructure, especially of road betterment (Souza, 1992). This was done both for the city centre and for the periphery. The separation between social groups on the periphery is enhanced by the assessment of frontage values for properties located in the condominiums. Low frontage values in non-fenced public housing estates, in contrast with high values in fenced condominiums located next door, show how location and proximity in themselves are not a main aspect in the separation of social groups (see figures 1 and 4b).

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There is a justification for higher income groups paying more tax, local government fiscal law justifies that taxation of properties located inside fenced areas are like those of high rise building in which each dwelling has to pay as if located on the alignment of the main access. On the other hand, the location of fenced developments on the periphery needs to be analysed in the context of how they limit accessibility, especially for public transport, for dwellers of social housing estates that adjoin them.

The co-existence of social housing schemes and condominiums on the periphery of Belem has been used in analysing relationships between the spreading city and frontage valuation for revenue-raising. Spatial factors contribute to the establishment of value in the case of Belem only to properties located at the main core of the city. At the fragmented sites on the periphery, at the global level, there is a lack of articulation of new layouts to the urban grid to connect the periphery within the city structure. The pattern of occupation in condominiums and social housing presupposes that economic viability does not depend on location itself but on the internal layout of the developments. In the case of gated condominiums, the importance of the layout was seen as more determinant than the location itself. The simple fact of accessibility to a link road is assumed by developers to produce a successful location for condominium development. Segregation of social housing is created by the road pattern in their surrounding areas, and by their disconnected layouts.

Local integration has been shown more pertinent to successful integration in the analysis of the city main core. On the periphery, where clustered developments are fragmented and linked to a solitary axis of the city road pattern, lack of integration gives evidence of the deprived character of social housing areas. The global integration analysis was useful to show that the segregated clusters of higher value condominiums do not create more opportunities for social interaction within the urban grid. Instead, it was seen that the construction of such patterns need to be revised. A correction in local government policies could be made by creating secondary accesses, which would increase the potential connection of social housing layouts to their surroundings. Nevertheless, unlikely giving rationale rationale of condominiums.

The study showed that physical integration has direct relations with property values and the degree to which locations are integrated into the city. The comparisons between the deformed grid of the city core of Belem and the radical hierarchical spatial pattern created by the location of housing estates on the periphery has raised important research issues. The study shows that global integration of developments occurring at different periods of the city's evolution potentially restrict social interaction. Relationships between physical structure of the global city and the distribution of frontage values on the periphery are indicators of social patterns of occupation. More than that, the role of the state in delivering services or not providing services can also be seen as maintaining or constraining social equity through policy priorities. Location and frontage values reveal how equity objectives are affected by physical accessibility, relating political and economic policy decisions about the location of housing developments and the provision of infrastructure in the city main core, where most jobs are located. The study has explored the relationship of spatial aspects of urban form and social disparities to challenge the capacity of local government in Brazil to provide more equity in the conduction of its urban development policy.

6 Notes

- 1 Block frontage is the road alignment formed by a building's facades or plot boundaries.
5 Spatial and political aspects of location in the grid: the case of Belem in Brazil

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