

# The morphological sense of commerce – theoretical review and lessons learned in four Portuguese medium sized cities

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**Abstract.** *Shopping has been considered the principal wealth-generator of post-modern societies. Yet, two elements continually elude current theories and practices about the role of commerce on a wider perspective. Rarely is it considered an active agent in the structuring of the city and, furthermore, most studies have solely focused on the geographical, economic and social dimensions of shopping, neglecting its morphological dimension. Only in the last 10 years have authors addressed this perspective, although sporadically and presenting focused views, resulting in a lack of knowledge and, ultimately, in the lack of proper public policies. This paper aims to address the structuring nature of commerce and the influence of its morphological component. For that it combines knowledge from various fields of research and a large array of morphological variables at various resolution levels. Using as test-beds four Portuguese medium-sized cities, GIS-models containing commercial, morphological, structural and temporal variables were produced, explored and compared. Findings include i) the definition of commercial / morphological indicators, that can constitute values of reference or comparison for commercial policies and other planning studies; ii) the evidence that morphological, rather than statistical similarities generate, on the micro-scale, more commercial similarities; and iii) the main bridging aspects between commercial activity and the form and structure of cities.*

*Key Words: commerce; medium-sized cities; urban morphology; Space Syntax; urban planning*

## Introduction – From geography and economy to morphology

Ever since the Industrial Revolution, when the ‘shop’ gained a permanent physical location within the city and became ‘aware of itself’ (Pessoa, 1926), the act of shopping has become an integral part of city-living. If cities have evolved from ‘artifacts’ (Karaman, 2001) to ‘organisms’ (Moudon, 1997), commerce has evolved from being considered just an ‘economic activity’ to an ‘experience’ (Pine, Gilmore, 1999), as the paradigms of both commerce and consumption change (Cachinho, 1994). Indeed, there is a growing interest in the proven capacity commerce has of driving urbanization processes, and of promoting and developing successful urban spaces, boosting their economic and social value (Whysall, 1995; OdC, 2000a; Evers, 2001; Lowe, 2004, 2005; Emery, 2006; Fernandes, 1994; Balsas, 2000, 2001; Moreira et al, 2006).

Yet this understanding of commerce as a structuring element of the ‘organic’ city has never been given enough importance, nor in the literature nor in policy-making (Balsas, 2001; Musso, 2010; Grant and Perrott, 2011). Commerce has mostly been considered a consequence of markets and urban and social behaviours (Borchert, 1998), i.e. commerce was deemed to seek the best locations after-the-fact, and furthermore no-one assumed that the presence of retail spaces could be, in itself, a cause for the shifts in value of given locations.

In this framework, various fields of research have studied commerce. Historians and geographers have weaved the evolution of commercial patterns and hierarchies over time (Kwan-Yiu, Kong-Sut, 1971; Guy, 1976; Lee, McCracken, 1982; Axenov et al, 1997; Borchert, 1998; Wang and Jones; 2002; Fernandes, 2003; Fernandes and Martins, 2003; Shan, 2004,

Cachinho, 2002, cit in GECIC, 2005), based on hierarchical organizational theories such as the Central Place Theory, the Spatial Interaction Theory, the bid-rent theory or the principle of minimum differentiation (for a review see Clarkson et al, 1996; Saraiva, 2013). Sociologists have tried to understand the behaviour of the shopper (Gregson et al, 2002; Sinha, 2003; Sinha and Unyal, 2005; Sarma, 2007) and of those who sell (Varanda, 2004). And economists have dwelt on the values of location, in terms of market-shares (the retail location theory – RLT), using various mathematical models (reviews in Yrigoyen and Otero, 1998; Hernandez et al, 1998, Mendes and Themido, 2004, Reynolds, 2005, Saraiva, 2013). In this case the relationships with the external environment, with the location mix and with the consumer, are only briefly considered as catalysts for the optimization of sales.

These studies perform, all things considered, ‘simple’ geographical pattern comparisons, between the location (or future location) of the store with the value (economic, social or statistical) that location generates. The site may ‘make the shop’ (Alexander et al, 1999), but the notion of location entails much more than a set of coordinates or statistics, the economic capacity of the customers in the catchment area, or the market competition. Location is accessibility. Location is built landscape. Location is layout and design. In other words, location is also morphology.

### **The morphological sense of commerce**

In 1958 Nelson wrote: ‘the emotional aspects of a location can be important to the success of a store or a shopping centre as the more obvious characteristics of convenience and access’. But his prophetic afterthought remained unanswered for decades: ‘But can stores or shopping centres be as important to the emotional aspects of location?’ Only in the past decade, authors have been calling attention to the lack of an urban morphology dimension in the commercial literature (Van Nes, 2005; Sarma, 2006) and to the lack of knowledge on how urban form affects the spatial distribution of retail activities (Villain, 2011). Urban environment conditions have turned, according to Axenov et al (1997), into the major group of factors that shape the commercial spaces’ market.

Yet most morphological studies still present a narrow view, are context-specific, and lack an interdisciplinary approach. Initial studies followed, more than they actually assumed, previous geographical / economic research, overlapping commercial distribution maps with those of socio-economic densities (Barke, 1998; Joosten and van Nes, 2005; Kompil and Çelick, 2006; Smith, 2006) or of land-use and transport networks at city level (Joosten and van Nes, 2005; Jingman, 2009; Villain, 2011), or even at regional or national level (Marques, 2003). Joosten and van Nes (2005) noted that most literature focused on the macro-scale, and had not yet zoomed into the micro-scale (street, building).

And when it does have, there is also a distinction, seldom overcome, between the study of the store itself and the study of the urban environment the store is part of. The first has mostly been non-morphological, interpreting type of activity, sales data or employee information. There are nonetheless some exceptions. Barke (1998) analysed window size, building type and occupation, and the existence of storage facilities, noting distinct morphological characteristics, highly inter-correlated, in buildings with only commercial use. These were also more correlated with the catchment area population than that of the local area. Allegri (2010) analysed the evolution of the physical layout of shopping centres and arcades in the city of Lisbon, whilst crime researchers have also analysed store layout (Saraiva, 2008, 2011) or product design (Lester, 2001), albeit with different purposes. The second, the analysis of the surrounding store environment, has read as yet another time-line of context, unrelated to the intrinsic characteristics of both space and commerce. The works of Fernandes (1993) or Tokatli and Boyaci (1999) display demographic, urban and political changes on one side, and commercial dispersion changes on the other, not linking them. Tokatli and Boyaci (1999) go as far as to mention the ‘changing morphology of commercial activity’ yet, in truth, only occasionally are

references made to streets, floors and building types. The inverse happens in many commercial urbanism projects, and in marketing and place-attraction studies (Teller et al, 2010), which discuss physical improvements to exterior elements such as streets, parking spaces, shop windows, or urban furniture, aiming to produce attractive environments able to induce shopping. Yet, in all, there fails to be a direct connection between particular stores and their surrounding morphological context.

This connection has nonetheless started to steadily emerge in the literature. Yoshida and Omae (2003) and Jostens and van Nes (2005) have compared store dispersal with the properties of blocks and buildings. For the first authors commercial blocks are distinctly associated to larger areas, volumes and building-to-land ratios. For the second, stores tend to full block typologies, characterized by high floor space index and build up street sides, preferably of smaller size and in medium-density zones, usually near main junctions or along the main streets. Only chain-stores and shopping centres tend to occupy non-block typologies.

The relationship of the store location with the accessibility of the network has also been the object of Space Syntax literature, or analogue models. According to Hillier and Iida (2005), activities that depend on movement will follow the grid's logic, and there will be a gradation according to the necessities of each particular activity. Morphology is here characterized through concepts of connectivity, either distance to closest intersections (Villain, 2011), or the weight of the store's street segment in the network, according to the so-called 'integration' or the 'betweenness' of the grid. Jingman (2009), using segment analysis in Chinese cities, concluded that city's commercial centres exactly correspond to city's syntax centres, both at a local and a global scale, and that almost all large-scale stores are directly located within sub-local syntax centres, in places connected to major thoroughfares and bus routes. Likewise, for van Nes (2001, 2005) shopping areas are only successful if they are among the highest integrated streets and the higher the density of streets in the vicinity, the more intense is the shopping street in terms of number, size and variety of shops. Yet the same author, in Berlin, found a weak co-occurrence between integration and the presence of shops (Joosten and van Nes, 2005) and Porta et al (2007) were keener to defend that the strongest correlation occurs with global 'betweenness' rather than with 'integration'. Furthermore some authors believe that this is not entirely true for all cities and all types of activity – the 'gradation' Hillier had already hinted to.

Sarma (2006), Hossain (1999, cit in Sarma, 2006) and Villain (2011) agree that commercial spaces whose sales (movement) are generated by their own attracting potentialities (anchor or specialized stores) have the tendency to be clustered together in central locations, although surviving in isolation. On the other hand, functions whose movement is just attracted coincidentally, like convenience and multi-purpose shopping, because they are more affected by competition and movement, are more dispersed, although in spatially strategic locations with high through-movement potential and serving local catchment areas. Only first necessity and some convenience stores appear to be a global phenomenon in the market, correlating both globally and locally with through-movement. This leads Sarma (2006) to conclude that distance is directly proportionate to social and economic class in terms of movement and in terms of shops. Teklenburg et al (1994) also stress that in suburbia, although the busiest shopping street is in one of the most integrated lines of the axial map, other commercial streets or department store locations are not. They established that in most cases where the most integrated lines for pedestrians did not coincide with the major store locations there was a co-occurrence of pedestrian and intense vehicular traffic.

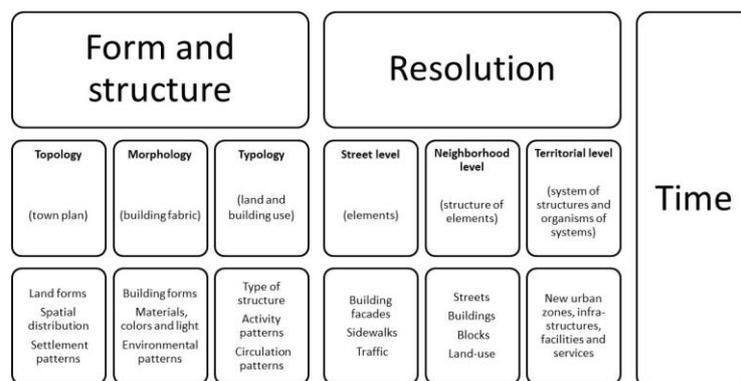
## **Methodology**

Although the studies that have tried to establish a connection between urban morphology and commercial activity are becoming more frequent, they seem to suffer from an exaggerated spatial and theoretical focus. Commercial, economic and geographical studies seldom look at

the micro-scale morphological element, syntactic approaches do not regard any morphological characteristic other than the location in the grid, and morphological studies do exactly the opposite, associating the measure of form and structure with the mapping of evolutionary geographical patterns, something which led Conzen (1980) to state that these studies were ‘amorphological’, and Whitehand (2007) that a ‘typological’ component, i.e. land and building use, and an interdisciplinary integration was missing. Each study usually uses only one method for variable comparisons, does not usually divide stores by activity or type, and dwells exclusively on one city or urban area. Joosten and Van Ness’s (2005) conclusion that stores are located preferably in full-block typologies may hold for Berlin, but it is easy to question its validity elsewhere.

In this context, this article wishes to synthesize the first findings of the research performed by Saraiva (2013), whose main goal was to establish to what extent the morphological environment is connected to the location, characterization and performance of commercial spaces. A multiple case-study approach and a multidisciplinary variable-analysis approach, were carried out. Four Portuguese medium-sized cities: Vila Real, Aveiro, Leiria and Évora, were selected, in order to get a diversified sample, according to their geographical location, their number of inhabitants (20-60 thousand), their structural importance in the urban network and their permeability to new commercial formats and commercial-urbanism programmes. The study area was made coincident with the so-called urban perimeter as defined in the respective municipal master plan. Within this perimeter, commercial and morphological variables were collected, street by street, building by building and store by store. The cities were later divided into two areas: the ‘city center’, and the ‘periphery’, which was also, in turn, divided into homogeneous areas (e.g. ‘residential areas’, ‘industrial/commercial areas’), and the analyses were conducted at these different resolutions.

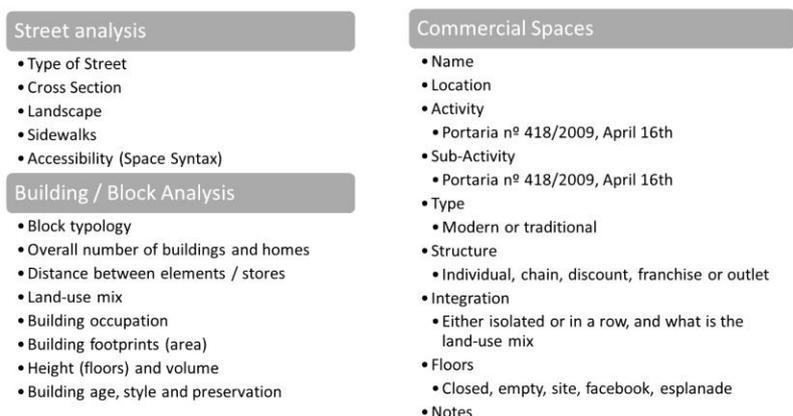
According to recent Urban Morphology literature, the ‘morphological sense’ could no longer be described as just the study of form, but of form and function over time, in a given context, i.e. form and structure, that is characterized as having morphological, but also topological and typological components, analysed according to three resolution-levels: street, neighbourhood and territory (Conzen, 1960; Lamas, 1989; Cannigia and Maffei, 1993; Moudon 1997; Karaman, 2001; Whitehand, 2001, 2007, Saraiva, 2013). Figure 1 portrays the general research framework in which these notions are present.



**Figure 1. Components of the form and structure of a city, according to urban morphology literature (source: Saraiva, 2013).**

Figure 2 lists the morphological variables considered in the research. Streets were characterized according to their type (exclusively pedestrian or not), width, quality and the size of sidewalks, building characteristics, an accessibility measure and the amount of movement. These last two were measured through Space Syntax. According to Hillier and Vaughan (2007),

60 to 80% of movement flows can be accounted by the configuration of the grid. Sixteen different radii (in meters) were considered, and the results were divided into six quantiles, ranging from the most central (first) to the most segregated (sixth). Blocks were characterized according to their typology (full, hollow), land-use mix, statistical information concerning families and dwellings, and a set of distances (between built elements, stores and store types). Buildings were characterized according to their type and amount of occupation, their height, area and volume, and their age (before and after 1975), style and preservation. A wider contextualization based on planning, historical and geographical backgrounds, expressed the ‘territorial level’ resolution.



**Figure 2. Morphological and commercial data collected in the research.**

The collected commercial variables can also be seen in Figure 2, and are intended to answer more specifically to the ‘typology’ component. These have not changed significantly since earlier works on hierarchical retail geography and location modelling (Kwan-yiu and Kong-Sut, 1971; Guy, 1976; Lee and McCracken, 1982). The classification by activities and sub-activities (e.g. ‘Food & Beverages’ and ‘Butcher’, respectively) was based on the Portuguese legislation (Portaria nº 418/2009 of April the 16th), even though a more expedite ‘retail categories’ division, based on necessity, presented by Sarma (2006), was also used<sup>206</sup>. Stores were also categorized by their type (modern or traditional – Fernandes et al, 2000), their business model (individual or family-owned, chain, franchise), their integration in the building (building type and occupation, and how much space they occupy) their integration in the street (relation to other stores), their web-connection and their status (open, closed or empty).

During 2011 (the year of the most recent population Census) a total of 7.898 individual stores in the four cities were catalogued, and the information was uploaded into a GIS platform. Following Saraiva (2013), research was carried out in five main stages: an overall geographical, organic and statistical definition of the four cities; the assessment of the physical distribution of commerce; an extensive commercial characterization; the characterization of blocks and buildings containing commerce; and the characterization of streets containing commerce. This paper focuses on the last two stages, although the analysis is transversal and closely related to the other three stages as well.

<sup>206</sup> Sarma (2006), inspired in Eaton and Lipsey (1982), divides commercial spaces in six categories: M1 (Multipurpose 1 – related to first necessity goods of local accessibility), M2 (Multipurpose 2 – rely on a larger customer base, such as banks or bookstores), MC (Multipurpose-Comparison – like fashion, telecommunication or sporting goods), C (Comparison – such as home or car related products) and S (Single Isolated Purchase).

## Results and discussion

One of the most striking findings was the great commercial similarities between the case studies when the differences in study area and number of inhabitants were taken into account. The four cities have, approximately, the same number of inhabitants per store, stores per urban area and per street length, similar hierarchical commercial structures and location patterns, and similar percentages and distributions of store type, structure and status (Saraiva, 2013). When morphological variables are placed over these distributions, the similarities are maintained which can only mean that the distribution of stores is not random, depends on form and structure, and can be quantified. Accordingly, commercial spaces are usually in buildings with similar average heights (3-4 floors), with similar areas<sup>207</sup> and volumes per store, and the same overall number of stores per block (6) – see Table 1. There are also similar hierarchical commercial street networks in all cities (from the central pedestrian street to the suburban thoroughfare), and there are even similarities in the distribution of stores that are in buildings constructed after 1975. Their percentage is approximately the same in all peripheries (around 70%), and so is, in all four cities, and for  $r = n$ , the percentage of these in the segments of the second and third quantiles of integration and choice (respectively 60% and 40% of buildings – Figure 3).

Obviously, there are exceptions, most of which are a consequence of particularities different cities present. For example, Évora never has similar indicators whenever building height or age is a variable, because the city centre is a world heritage site. The rural nature of Vila Real's periphery also leads to fewer stores, which reduces some indicators. Nevertheless, these exceptions usually occur in only one city. Furthermore, most of the indicators that are not in the same order of magnitude in all or in three of the case studies, are similar in pairs. And these pairings seem to be much less dependent on economic and even commercial variables (such as purchasing power, degree of local economic development and overall number of stores), and more on the morphological ones.

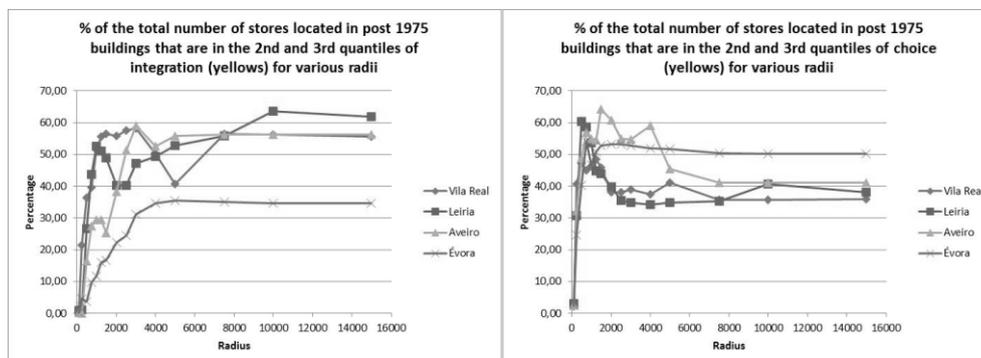
**Table 1. Commercial building and block data, by cities, by city centres and by peripheries.**

Cities	Vila Real	Aveiro	Leiria	Évora
<b>City</b>	<b>183</b>	<b>258</b>	<b>244</b>	<b>204</b>
City center	140	147	144	101
Periphery	292	403	376	300
<b>City</b>	<b>3,71</b>	<b>3,76</b>	<b>3,77</b>	<b>2,23</b>
City center	4,1	3,97	4,26	2,45
Periphery	2,82	3,49	3,14	2,03
<b>City</b>	<b>233</b>	<b>358</b>	<b>442</b>	<b>441</b>
City center	99	154	173	172
Periphery	134	204	269	269
<b>City</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>4</b>
City center	10	8	8	5
Periphery	3	5	4	3

Leiria and Aveiro are larger, more developed cities with more stores, commercial area and diversified store types, something which appears to corroborate Barke's (1998) proposal that commercial development is dependent on the regional number of inhabitants. Yet, when comparing store data with network and building properties this does not ring true. The similarities are clearer between Leiria and Vila Real, and between Aveiro and Évora (as it is seen in Figure 3 for local radii), simply because, in each pair, the cities have much more in

<sup>207</sup> The store was deemed to occupy the whole implementation area of the building.

common in terms of form and structure. Exploring this idea, several considerations can be made.



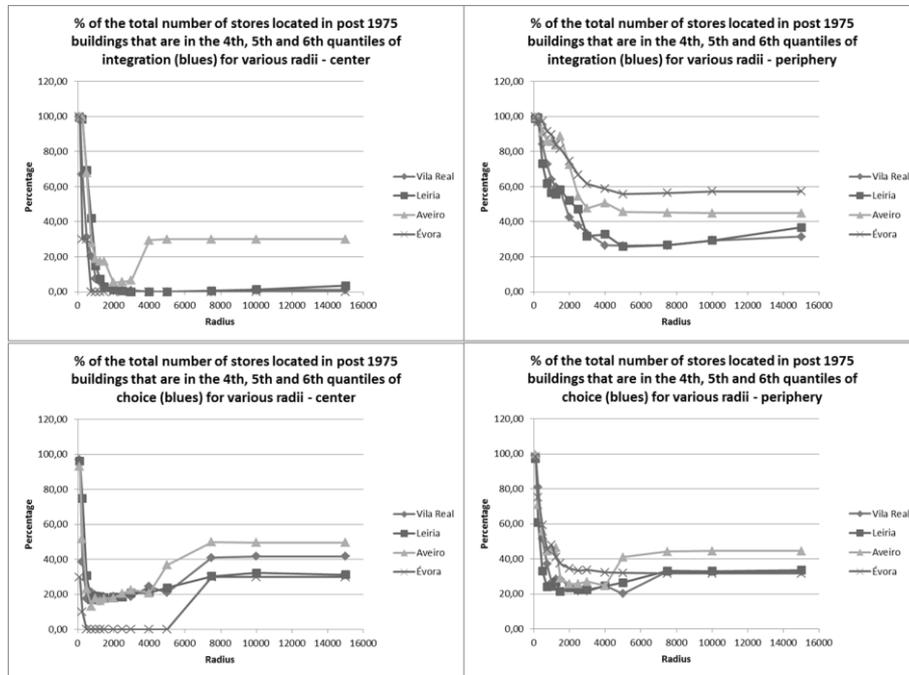
**Figure 3. Percentage of the total number of stores located in post 1975 buildings that are in the second and third quantiles of integration and choice, for all considered radii.**

The first, which is often neglected in commercial studies, is that it is virtually impossible to dissociate the ‘store’ from the building it is in. Only one in five stores (and one in ten in Aveiro) is in a purposely-built structure for accommodating exclusively commercial-use. It is then safe to assume that in most cases these buildings were erected bearing in mind the specificities of the existing other uses in upper floors (mostly residential), and not those of commercial spaces. The morphological variables associated to the store are therefore not their own, but are related to the building they occupy, and to the street and the block in which that building is located. If this establishes the building as the most important morphological element that influences commerce it also gives strength to the hypothesis that commerce is a mere consequence of land development.

But this constitutes a half-truth. This research found that residential neighbourhoods without stores are not crossed by main streets, are usually in segregated areas of the network, have closed and small street and block structures, and only seem to influence the structure of the public transport network, as they attract transit stops. Residential buildings with stores, however, assume an entirely new significance. In the city centres major traditional ground-floor commercial streets have been maintained, despite the proliferation of commerce in new centres and in main residential localities. The weight in these locations of activities such as MC, M1 and M2 (see footnote 2) has actually been crucial in the conservation of their liveability but this is not the only reason (all cities have, for example, 80-90% of all their fashion stores in just the main central streets). Structurally these corridors constitute the most central or travel-through locations in the city centres, so it can be said that commercial construction has influenced centrality instead of being a consequence of it. Vila Real’s secular and central pedestrian street is still one of the most integrated segments of the entire city-network. But, at the same time, this position of centrality may also explain why stores have established there and why they have a continuous success, which can mean that Nelson’s two questions may have exactly the same answer as ‘who came first, the chicken or the egg?’

This duality is maintained when recent construction containing commercial spaces is analysed. On one hand, these new buildings are generally located in the most central lines possible (‘integration’), but also in the lines with the greatest travel-through potential (‘choice’) when in peripheries, which seems to suggest that their location is to some extent dependent on the pre-existing network structure. But, on the other hand, the appearance of these new buildings, especially in the urban peripheries, has been simultaneous to the opening of new axis (the plot by plot development formed the street), so they have influenced, in their own right, the properties of the network, particularly at the local level, where only 20% of stores in post-1975 buildings are in segments of the last three quantiles (Figure 4). Consequently, new streets with

commerce have generated larger local centralities influence radius by establishing a connection to, or becoming, the main peripheral axis. This not only grants greater access of surrounding areas to the local commercial poles but also permits a greater connection to the thoroughfares leading to the city centre, maximizing their feeding capacity.



**Figure 4. Percentage of the total number of stores in the centers and in peripheries, located in post 1975 buildings that are in the last three quantiles of integration and choice.**

These new buildings are associated to specific morphological characteristics, which however seem to depend more on the location inside the urban perimeter than actually on the type of commerce they contain. The number of commercial poles of recent formation, as well as building heights, road-size and road complementarity decreases and block area increases with the distance from the centre. This contradicts the works of Yoshida and Omae (2003) or Joosten and van Nes (2005) that allocate specific, non-changeable, morphological features to commercial spaces. With the exception of particular store types which tend towards specific locations (like commercial services generally seeking buildings with other services), most commercial variables, particularly in the centres, have even distributions between the various types of buildings and blocks, with the only particularity that they constantly tend towards the larger side of blocks. At the same time, modern stores are very rarely in buildings and neighbourhoods constructed before 1975, which may mean new stores need new buildings. Stores in these buildings are in greater number, closer together ('door to door') and more spatially organized, which increases the chances of success as commerce performs better in proximity. 'New' buildings are usually located in larger blocks (a prevailing tendency for commercial spaces), the stores therein have more esplanades comparatively – use more public space – and as they usually are farther away from the street they also condition size and type of the sidewalks. This means that commercial buildings condition blocks, sidewalks and streets.

In any case, exclusively commercial buildings also impact on the landscape. Commercial arcades, shopping centres and warehouses obviously possess the greatest areas and volumes. They can also be extremely beneficial to revitalize main street shopping, as the literature suggests, but in these case studies they are only successful if they are close to pre-existing main shopping axes, regardless of overall accessibility, and if they have a limited number of store spaces. On the contrary, in the peripheries, large shopping centres appear and survive in isolated

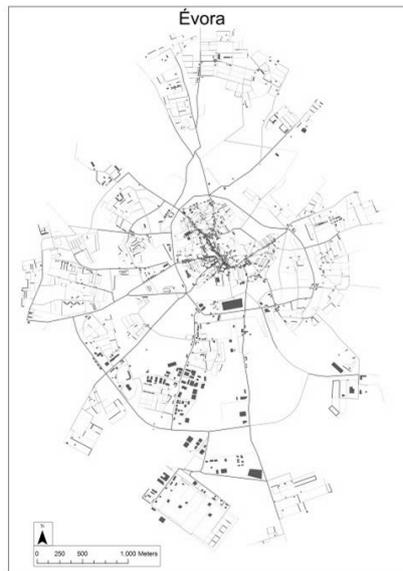
areas, but they quickly stimulate commercial and residential development close-by. Actually, they seem to appear more frequently in peripheries without clearly defined centralities. Considering the example of Aveiro, a city with various shopping centres in the periphery and that, over the years, has linearly expanded through edge-roads, it could be speculated whether the lack of well defined commercial and urban centres cannot influence the appearance of these spaces.

Other than the type, age and nature of 'buildings', commercial variables seem to be more affected by the form and organization of the city. This structure obviously conditions the characteristics of the segments that form the network, of which store types seem to depend. Actually, they are more affected by this positioning (centrality, through-movement, closeness to an element) than by any other morphological characteristic of that position. But, at the same time, this position also conditions the morphological characteristics of the elements, because these are likely to change from the centre to the periphery, and from the main local road to segregated neighborhoods, and it also conditions how localities are connected between themselves and how hierarchies are built, something which, again, affects commerce.

For one, 'streets' are the second greatest morphological element, especially in the periphery where most commercial clusters favour through-movement (70% of stores are in high quantiles of choice, against around 40% in high integration quantiles), and where urbanized ring roads, expansion thoroughfares, and local or regional roads passing through the centre of localities are the distributors of development, as most localities tend to develop around or facing them. Greatest connections mean more commercial strength, not only of the ribbons per se, but also of the poles these ribbons connect. Connection means continuity, and in these concentrations the number of stores reachable is proportional to the distance travelled. When continuity is broken, the development and type of the commercial poles in the extremities change. In Vila Real's centre, for example, there are no commercial ribbons connecting the older and newer commercial centres. This may be one of the reasons why the second ones have still not been able to surpass the first. A link is a natural element for change, rather than a complete and abrupt shift in position. Other non-urbanized and non-commercial connecting axes can also be prejudicial for development. Ring roads in Aveiro and Leiria, for example, decrease the accessibility of the main streets and consequently of the main commercial areas. In Vila Real and Aveiro the lack of connection points between the centre and the periphery also segregates several commercial poles inside residential neighbourhoods, and makes it more difficult to access the centre. This causes the creation of competing stronger poles outside the city centre, obviously changing the morphological landscapes and development capacity of these areas. On the other hand, in Vila Real and Leiria the thoroughfares that unite different localities become, at the extremities, main local streets. Because the axis is the same, this considerably improves both the through-movement potential and the centrality of these localities, which helps to maintain their commercial structures, at the same time as it stimulates continuous development. The same does not happen in Aveiro and Évora, where the connections between main local roads of different localities, and between these and the centre, are not direct, despite the existence of very high through-movement axis, as is depicted in Figure 5 concerning Évora. This hinders the creation of centralities, and allows for older traditional axes to be substituted by stronger commercial poles in multi-family buildings located in or around the main through-movement axes. This peripheral store necessity (to be near 'choice' axes) clearly influences the location of the building and, consequently, it influences the location of all uses in the building.

Therefore, the form of the city can also influence commercial behaviour. Leiria and Évora have shopping centres inside the urban perimeter, and central traditional commercial areas inside the centre, unlike Aveiro and Vila Real, so, naturally, they have a clearer hierarchical and commercial structure from the core to the periphery, which increases the centrality range and the local 'choice', attracting specific activities accordingly. As a result, the closest peripheral localities are more connected to the centre, which should explain why these two cities have more developed communities, overall, in the periphery. In the peripheries of Aveiro and Évora, the expansion in edge-axes (as is clearly seen in Figure 5) and the lack of closed hierarchical

communities is negative, in a sense that it produces weaker commercial centralities, but positive, in a sense that zones gain multiple hierarchical purposes, something which can influence variables like 'building height' and 'pedestrian accessibility'. Despite the similarity in the overall physical location patterns of stores in the same hierarchical zones of different cities, the morphological composition of these zones may be different due to these nuances, which are caused by residential areas, commercial buildings and accessibility. These are then three crucial elements affecting the 'emotional aspects of location'. On the other hand, symmetry, like the one found in Évora, also contributes to the creation of similar 'integration' and 'choice' patterns, i.e. stronger axes that are attractive to stores. This, in turn, influences the 'emotional aspects of stores/buildings with stores', so it is rather difficult to ascertain where the cycle begins and ends. Other physical constraints have also been proved to affect morphological characteristics of commercial blocks. Slope, for example, can affect geometry and hinder urban and commercial expansion.

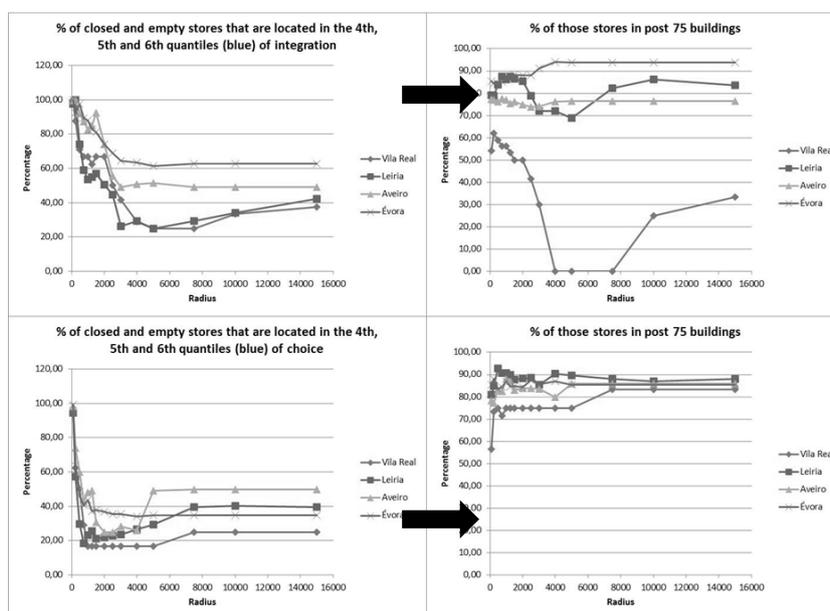


**Figure 5. Évora choice map for  $r=n$ . Buildings are not represented, but stores are signalled with a green colour.**

Consequently, these physical variables and the historical expansion of the city commercial landscape seem associated to the appearance of 'closed' and 'empty' stores. The first are generally in older areas, which have lost their vitality and, comparatively, their spatial attraction (due to changes in the network), whilst the second are usually in new neighbourhoods. The number of these is sometimes so excessive in new commercial poles in residential areas that it has to necessarily mean that these stores lack of success is not a consequence of location or competition, but simply of a lack of market need for more store space. As the centres are the greatest commercial destinations, stores therein are hardly in segregated segments, so conclusions are hard to draw. In the peripheries, however, we can see that, although stores are generally not on global centralities, if they are not even in local centralities / destinations then their chances for success are much reduced. Even so, local centrality may not necessarily be a guarantee of success, because what stores need in the periphery is to be in axes of high 'choice' potential or, at least, at the distance where they can be reached easily. For 'integration', and for  $r < 2000$ , more than 70% of closed and empty stores in the peripheries are in segregated segments. Furthermore, over 80% of these non-open stores are in buildings constructed after 1975, which helps to understand why older axes still withhold and why the construction of buildings containing commercial spaces cannot occur in any given location inside the urban perimeter (Figure 6). The drop to zero in Vila Real is explained by the rural nature of its

periphery, as stated before. Stores not on the ground floors are also comprehensibly unpopular and perform worse.

These findings can definitely dispute the hypothesis presented by most Space Syntax researchers that stores are preferably located in first quantile segments, and also Jingman's (2009) findings that a city's various centres correspond to various syntax centres. Indeed, these types of research are generally conducted in the centres of large cities. As Teklenburg et al (1994) had already suggested some twenty years ago, the commercial landscape in smaller cities has a different behaviour, especially outside their centres. If in the centres stores seek mid-range centrality, in the peripheries they seek through-movement, benefiting much more from global than from local 'choice'. Stores do not want (for market reasons), cannot (for financial reasons) or are unable (for structural reasons) to be in the first quantile segments, which are often longer connecting roads or service areas. Because they seek movement rich locations, but also areas closer to a larger clientele (i.e. residential areas) and corners, they stand most favourably on perpendicular roads to the main streets and on intermediate axes of the network. For radii over  $r = 3.000$ , over half of the stores are in the second and third quantile 'integration' lines and between 40%-50% of the stores are in the second and third quantile 'choice' lines.



**Figure 6. Percentage of closed and empty stores, in the peripheries, located in segregated lines, both for 'choice' and 'integration', and the respective percentage in post 1975 buildings.**

Likewise, when Sarma (2006) reveals that MC, C and S categories (see footnote 2) do not correlate with 'choice', he grounds this statement on the analysis of a central location. In the case-study peripheries, for example, C stores are, logically, in travel-through thoroughfares and segregated out-of-the-way areas, and S stores, because they require space and have strong attraction by themselves, can locate just outside the centre in areas with limited attraction. As well, in the centres, even though M2 and MC stores have a strong affinity to first quantile segments, both of choice and integration, first necessity M1 stores obviously drift towards segregated (residential) neighbourhoods.

## Concluding remarks

By combining, in four medium size cities, several morphological and commercial characteristics of stores and of the buildings, streets, blocks and neighbourhoods they are in, this research has established a link between the form and structure of cities and the commercial landscapes they possess. Actually, there is evidence that cities or city areas with more morphological (rather than statistical) similarities will have, on the micro-scale, more commercial similarities, something which strengthens the validity of what we called the ‘morphological sense’ of commerce. Based on the similarities between case studies, some reference-values were established and we found that the location, characteristics and performance of commercial spaces is to a significant extent connected to the following six aspects: (i) the amount, type and age of buildings and their distribution; (ii) the location of residential areas and whether they have commercial rows or not; (iii) the way urban hierarchies are structured; (iv) the configuration / form of the localities, that is, the structure of their blocks and of their street networks; (v) the relative position of the centres inside the localities; and (vi) the way localities / areas are connected through urban ribbons.

Nevertheless, the above commercial spaces features are not exclusively dependent upon these aspects. Because the store is intrinsically connected to the building it is in, it is almost impossible to state undoubtedly that the proven influence on a given area’s development, residential growth or degree of centrality is caused exclusively by the store and not by, for example, any of the other uses a given building accommodates, or even by the mere existence of the building (or the street) itself. But the truth is the store is indeed there, it is open to the public and it is more directly entwined with the economic, social and morphological realm of the area it belongs than any other residential or service use the building might contain.

Therefore, the store is not only an economic motor and a wealth-generator, but also a city maker. It can produce centralities and friendly public spaces, and can command the location of new neighbourhoods and of new streets. Consequently, it can influence, among others, demographic and social indicators. In other words, commerce can indeed be an instrument of urban planning. With this in mind, the permissiveness of construction in general and of licensing of commercial establishments in particular could be substituted by a more comprehensive and demanding vision that would ultimately be much more beneficial to urban spaces. The similar thresholds found in our research can, for example, at least for cities of the same type, safeguard the construction of unnecessary store spaces (and hence avoid the scenario of empty stores), show excesses or deficiencies of a particular activity in a particular area, or regulate the construction of peripheral commercial poles, placing them close to a ‘choice’ thoroughfare, for example, to maximize the influence range of the stores therein. If there has not been a planning for commerce (Guy, 1994; Fernandes et al, 2000) but just a global planning that mentions commerce occasionally (Borchert, 1998), then looking at commerce from an urban morphology perspective can supply the necessary knowledge to start doing just that. Fuller (cit in Ratti, 2004) said ‘reform the environment, stop trying to reform the people. They will reform themselves if the environment is right’. If, substituting the word ‘people’ for the word ‘shop’, the sentence still makes sense, then this way of thinking, as well, makes sense.

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