The sequential development and the consequent urban patterns of Bucharest

Thesis of: **MSc. Built Environment**
**Advanced Architectural Studies, 2004-2005**
**University College London**

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The main thrust of this thesis is to investigate the intrinsic morphological and topological properties of an urban layout. The study will be focusing on Bucharest, a city built of distinct historic phases and fragments which is facing the need to adapt to new European standards at the same time defining its identity.

Syntactic analysis of a spatial configurational model together with classical comparative methods will be used for a fundamental understanding of the urban system. A two phased analysis will be developed. Revising previous hypothesis, the emergence of the city will be discussed illustrating consistent differences between particular stages of its evolution. The argument will be based on previous studies of configurational differences and similarities between cities, done by Hillier (2001), Karimi (1998) and others under the Space Syntax framework; and on morphological urban analysis of Jacobs (1993) and Panerai et al. (2004). Certain transformation in the city structure that occurred under the socialist regime will be proven to have significant effects on the whole configuration of the system.

Considering the representative and functional role of the city centre, a second aim will be to produce an evaluative analysis of the major intervention on the city centre that was implemented in the 1980’s as a reflection of the political regime, compared to the contrasting configuration of the old centre.

The paper will refer to conjectures relating the socio-economic drive and the different modes of employment of space trying to grasp the logic and reasoning behind the distinct spatial systems and how they function together.

As a conclusion the paper aims to illustrate once again the functional implications of spatial modelling decisions and objectively question the future development potential of the current configuration on the background of the present concern for the regeneration of the city.

Key words  Space syntax, Bucharest, urban layout typologies, socialist planning.
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Acknowledgements:

For the research presented in this thesis I owe special thanks to my tutor, Dr. Laura Vaughan for her guidance and support.

I am also grateful to Prof. Bill Hillier for the primary suggestions and opinions on the study case, and to Biljana Savic for sharing the expertise gained on a similar research topic.

Finally, I would like to credit professors Anca and Georgica Mitrache of the University of Architecture and Urbanism Ion Mincu, Bucharest, for the cartographic information and other data provided and Space Syntax Limited for the technical support.

The current thesis is motivated by the idea that the transformation of a territory, as Bucharest is undergoing during the past decade, has stronger chances to be carried out effectively if it is guided by a prior understanding of its identity.

Introduction

On the background of widely debated conjectures, this paper will aim to bring a spatial network perspective over the difficult task of understanding the form and performance of a city. The subject has been partly inspired by Bucharest’s recent concern for identity and principles of development raised by the extension of European Union; calling for the architectural profession to elaborate on it, considering the underlying cultural patterns of each territory, its inheritance and legacy, and translating it into a functional entity according to global values. The set of values to be achieved by a “European city” remains an ample open issue while the current study will be addressing the problematic of its resulted identity as a spatial system. Within the urban layout the role of city centre is essential for a functional model and maybe most difficult to understand since it involves many layers of built form and different functional thrusts. Therefore the second aim of this paper is to investigate the relationship of distinct central clusters aiming to explain their functionality as a product of their spatial configuration.

The methods used will be based on previous practice under the framework of Space Syntax theory coupled with comparative research. Comparisons will relate to quantitative accounts of representative urban layouts previously studied and the syntactic analysis has proved to be a valid tool in understanding urban layouts, which through their effects on movement flows influence the evolution of land use and life patterns of a city. The benefit of the chosen methods is that they will deliver an account reflecting the functionality of a system only on the basis of spatial configuration, therefore systematic and objective throughout.

Hypothesis of the functionality of the city will be correlated with real activity based on plans of the urban/local development plans, present land-use distribution maps, previously published critical accounts of the studied areas, as well as on the experience and photographic evidence of the author of the this paper as having studied the area as part of previous academic program. Observations were not relevant at the moment of the research due to the fact that as part of the regeneration plan of the historic centre of Bucharest it was partly evacuated and closed for traffic. One other constraint was posed by the absence of detailed maps previous to 1852 and the scale of the existing maps, 1/15000 being the highest resolution before 1995.
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The study was divided into five chapters. The first part of the study illustrates the origins and basic transformations of the city in relation to geographical, economic and sociologic issues. It also presents several conjectures about the models and influences assimilated by the city. They are essential for the understanding of the tendencies of Bucharest’s past and present urban planning and founded the hypothesis of evolution proposed and explored by this paper.

Next, theories of urban form and centrality, some based on previous research from the Space Syntax sphere will be briefly explained. Their most explicit outcomes will be presented to fundament the analysis and diagnosis on the evolution pattern and resulting form of the city.

The third chapter will investigate the most significant stages of development under the constraints of the available evidence. A hypothesis proposing the gradual transformation of the city structure from an Oriental to an Occidental (Western European) model will be tested on the basis of theories discussed in the second chapter. Furthermore a final major transformation will be depicted by the analysis, not only from one spatial model to another, but primary to that from one logic of use of space to another; from an instrumental use of space regardless of the regional influence to a symbolic use.

After establishing a model of growth, the paper will continue with the analysis of the central structure outlining a severe conflicting situation from a morphologic and experiential perspective.

In the fourth chapter the formal and structural gap between the historic core and the civic centre will be quantitatively measured. The characteristics thought to be accountable for the malfunction of the whole system will be reviewed trying to suggest their influences.

The last phase of the current paper attempts to summarize the characteristics of Bucharest’s layout and to speculate on the potential to satisfy socio-economic requirements in processes of future development.
Chapter 1: Contextualizing theories on the discontinuous evolution of Bucharest

Next to a brief report of the historical evolution of Bucharest this chapter aims to review theories about the evolution and typology of the city some recently developed and some others rather old, yet all being recognised by many Romanian critics and therefore serving for the purpose of contextualizing the current research. Some of them will be investigated in the course of the paper.

The first map documenting the built form at an appropriate utilizable scale is only available late in the course of its existence, in 1852, though the first documentation that attests the existence of Bucharest dates from 1459.

Fig.1.1 Map illustrating the phases of evolution of the city limits
The city grew concentrically as it can be seen from the consequent radial rings; starting from 1555, second was defined during the time of Mihai Viteazul (1593-1601), the third in the mid 17th century, the fourth in the second half of the 18th century and the last at the middle of the 19th century (fig. 1.1). After the mid 19th century the built realm has been almost completely replaced due to fires that destroyed the settlement.

Reflecting ‘the attraction of the Occident’ and reinforcing the complex of the market town (albeit the nostalgia), authors like Octav Doicescu and G.M. Cantacuzino, make the affirmation that Romania didn’t have a historical model of city in the sense realised in Western Europe, but was based on a rural society and commercial trading points. Accordingly, the post Byzantine City (XV – XVIII century) was erected starting with the original axis on the commercial transit ways from and to the Ottoman Empire (fig.1.2).

As there were no fortifications needed (being a vassal of the Ottoman Empire) there were no conditions to form the dense bounded urban structure characteristic to central and Western European cities. Instead, theories consider that ‘spiritual centres’ were the main system of organisation of Bucharest into parishes determining a diffuse, discontinuous structure, according to Harhoiu (1997) even controlled by geometry (fig.1.3). Though such a rigorous and holistic planning of the city is questioned by Augustin Ioan’s (2000).

In the Fanariot City (XVIII century) ruled by foreigner lords from the Greek community in Constantinople, the architectural language was strongly influenced by
Chapter 1 – Contextualizing theories on the discontinuous evolution of Bucharest

Constantinople. New types of space were introduced as the ‘urban caravanserais’ and major changes took place in the urban structure by the appearance of empty plots, gardens and ‘maidane’ that were the public meeting and trade places where social life took place.

Starting with the French Ambassador Paul Maurain in his book “Old Bucharest” (1930), the Old Quarter was described as the area where East meets West. Recently Harhoiu (1997) also portrays Bucharest as a city between Orient and Occident, referring to its formal (fig.1.4) and functional organization. Against these theories, the orientality of the city was discussed by Ioan (2002) as it is largely a post ottoman product. This debate will be tested in the next chapter using different measurements found to be alike for different regional models.

![Fig. 1.4 Street structure of Bucharest in 1852 compared to Constantinople (Harhoiu, 1997, p.37)](image)

The occidental model can be traced back to the period of the independent Kingdom of Carol I when the irregular development of Bucharest has been changed systematizing 95 km of new arteries (1895-1899). The operations were finalized in between the two World Wars by a complete capture and “de-sacralization” of the old city within the new structure (fig.1.5). It was described as a garden city and called “little Paris” (fig.1.6). The nucleus of the city, Curtea Domneasca and the adjacent commercial zone in the north-east of it were extended to the north by the route to the ruler’s court, Podul Mogosoaiei (today Calea Victoriei), becoming after 1920-1930 the banking sector. Ioan acknowledges that architects of French traditions “disfigured the city, by way of “reconstructing” age-long

1 oriental style inns built around a large court for accommodating caravans at night
2 Romanian historic N Djuvara quoted by Harhoiu says that in this period “the Romanians were colonized by French without the presence of the colonizers”. (Harhoiu, 1997, p.59)
monasteries” (Ioan, 2002, p.192). In a period dominated by French cultural inspiration and financial affluence, on the new boulevards in the manner of Napoleon III and Haussmann, small palaces, restaurants, theatres, cinemas and other premises where social life could be exposed were the new landmarks of the city, replacing ‘caravanserays’, markets and spiritual centres. He further proves that no other further developments of the city recall the French model.

Fig. 1.5 Comparison between Bucharest including the systematization of the end of the last century and Paris with the Haussmannian interventions. (Harhoiu, 1997, p.62,63)
This was followed by the socialist period (1945-1989) which reflected the main ideas of the regime: control, uniformity, density and centralised economy. The urbanism was following the centralization of industrial zones, while the dwellings to host the population forced into these created jobs were standardized and used regardless of any given geography (fig.1.9). The focus was on big scale interventions in the city meant to display power and solidity producing an environment, that is considered today to be out of scale and time. Still in search for the French model, the grandiose edifice\(^3\) meant to host the dictator and his government, the House of the People, was adopted as “our Versailles”. The commonly used comparison of the Unirii Boulevard (formerly known as Socialist Victory) to Haussmann’s Champs Elysées will be thoroughly discussed later in this paper. The end of

\(^3\) Known as the second biggest building in the world save for the Pentagon
the Parisian model came with the proposal to bury the House of the Republic under a glass pyramid in 1991.

*Nowadays* the city is once again compared to Istanbul due to the recent sprawling phenomenon. Made of independent sectors (economically and politically), Bucharest faces great difficulty in finding a coherent development plan, each one of the sectors developing extensively rather than intensively, together with the phenomenon of decentralisation of the retail bringing sustainability and ecological matters. Also, as Ioan (2002) says, unlike in the traditional oriental model, in Bucharest the whole and is neglected and sacrificed in favour of particular investments, as a testimony being the genuine “maidan” altered into un-articulated, bare, residual, derelict lands resulted of violent interventions built-into the urban network.

![Fig. 1.8 The new extensive development of Bucharest versus the deprived centre and empty plots spread throughout the network](source: Octogon, 2002, [www.arch.columbia.edu/Studio/Spring2004/UD](http://www.arch.columbia.edu/Studio/Spring2004/UD))
Presently it could be argued that new models are necessary resembling either the radical and violent intellectual manifesto of Lebbeus Woods – proposal for Sarajevo, the more pragmatic winning proposal of Bucharest 2000 competition or the layered solutions presented by Kuibus (2002) at the Biennial of Venice, 2002.
Chapter 2. Theoretical premises: particularities of regions and ages of development

The following step will be to explain the background theories on which the current research will be built. Part of them were developed under the framework of Space Syntax theory set out by Hillier and Hanson in The Social Logic of Space (1968) on the fundamental hypothesis that society takes shape as a spatial pattern established in genotypes and forming phenotypes under particular conditions. Correlating to observed reality relations have been widely tested between social and economic forces and the formation of the urban grid on which they act through their requirements of patterns of occupancy or movement. Another part of the analysis relies on comparative urban analysis.

One speculation central to the analysis of the structure of the city is it being in between two typologies: Oriental (Asian) and Occidental (Western European). The hypothesis that this paper proposes is that as the city grew from an organic, less regular pattern, through additions and modifications, it tended towards an Occidental model, more intelligible with a clearer structure.

This conjecture will be tested using the models explained by Hillier in “The theory of the City as Object” (2001), reflecting previous theories that relate urban grids to movement flows and consequently to social patterns (Hillier, 1996, 2000). Hillier defines the urban grid as a “system of configurational inequalities” – that is differences in integration values in the lines that make up the axial breakup of the open spaces (appendix A.1). Examining a sample of 68 settlements from different regions he proves that there are configurational similarities in the global structure due to invariants in the driving social forces and to a set of spatial laws under which the generative process takes place. As well there are important differences in the local patterning created by cultural diversity imposing particular interfaces between users, and that is what makes this theory relevant for the present study.

For the purposes of the current paper, the characteristics of European and Asian (Oriental) cities were summarised considering the networks of spaces described by axial lines/lines of movement. Initial morphological analysis showed that in Oriental cities lines tend to stop on each other, except for when they meet in central public
spaces, and they intersect in a variety of angles. Comparatively in European cities the
lines intersect passing through each other and the angles of incidence of streets are
also closer to 90 degrees, yet less strong then in North American cities where this is a
global tendency. In all cities there is a small number of long lines compared to short
lines, and the difference becomes greater as cities grow. Nevertheless in Asian cities
longest lines are just a fraction of the radius of the settlement, they are peripheral and
radially disposed, while in European ones longest lines are close to the size of the
radius and they delimitate discrete groups.

The almost intuitive geometric differences explained by these
characteristics also create syntactic differences in values reflecting the relations in
which the parts of the system are with each other. Integration measures the
accessibility of a line, closeness to all others in the system – global (appendix A.2), or
restricted to a number of steps – local (appendix A.3) and the intelligibility the
consistency of the relation between local information that can be deduced from local
conditions of connectivity and the role of the line in the context of the whole system
(appendix A.4) synergy (appendix A.5) which informs about the interface between
global and local users. The table has been taken from the earlier mentioned paper of
Hillier (2001), and an extended table is attached in appendix A.12.

<table>
<thead>
<tr>
<th></th>
<th>Cities</th>
<th>Avg. Line</th>
<th>Conn</th>
<th>Loc Int</th>
<th>Glob Int</th>
<th>Intel</th>
</tr>
</thead>
<tbody>
<tr>
<td>usa</td>
<td>12</td>
<td>542o</td>
<td>5.835</td>
<td>2.956</td>
<td>1.610</td>
<td>0.559</td>
</tr>
<tr>
<td>euro</td>
<td>15</td>
<td>503o</td>
<td>4.609</td>
<td>2.254</td>
<td>0.918</td>
<td>0.266</td>
</tr>
<tr>
<td>uk</td>
<td>13</td>
<td>444o</td>
<td>3.713</td>
<td>2.148</td>
<td>0.720</td>
<td>0.232</td>
</tr>
<tr>
<td>arab</td>
<td>18</td>
<td>840o</td>
<td>2.975</td>
<td>1.619</td>
<td>0.660</td>
<td>0.160</td>
</tr>
</tbody>
</table>

Urban layouts were discussed also by Jacobs (1993) proving relevant
differences between numbers of intersections and numbers and sizes of blocks per
square mile for cities of different regions and different periods. Those comparative
maps and a table summarizing regional trends can be found for reference in the
appendix A.15, A.16.

The criteria of the capital route study of Karimi et al. (2005) (fig.2.2) enables
to identify representative samples of urban fabric, objectively pointing out the
importance of the central clusters that the current paper aims to examine.
All spaces contain and support a mixture of social activities, and Space Syntax research has proved that it coincides with the configurational centre, more precisely that the potential of destination spaces is depicted by integration measures and movement of people passing through by the choice analysis (appendix A.7). Therefore also analysis of both the measures could be used at different radii, as Way (2005) explains, experimenting with the scale at which centres operate. Furthermore recent studies of Hillier (2005) correlating movement patterns in areas of London with integration (closeness) and choice (betweenness) values using topographic, metric or angular logic, have found that segment angular analysis (appendix A.11) processing choice offers the better approximation proving densities based on route choice meaning network properties, and not destination (geometrical location in the whole).
With a metric radius also has the benefit of an improved capacity to differentiating within structures at very different scales.

The surviving historical hub and the uncompleted civic centre will be the subject of spatial analysis using various theories on centrality, including also aspects of syntactic centrality as explained in Hillier’s (1999) theory of the centrality as a process of grid and activity densification based on accessibility conditions within the local system. As centres evolve they create pressure for greater ease of movement within the variety of functions introduced (local integration), resulting in smaller block sizes and shortening metric distance. Driven by an economy of movement, the centre will then attract an even greater functionality and functional diversity. The process was described by Hillier (1999) as local grid conditions along certain lines. In the system covered by all the lines that are up to 2 changes of direction (2 steps deep) from “a centre” numbers of blocks are higher and sizes are smaller, and the shape of the area should be close to a circular or square form with integrated spikes living out from the main area — “spiky potato”. According to Hillier’s theory, such logic is present in naturally evolved grids, by process of natural movement and movement economy. (Hillier, 1999, p.15). When long routes/lines acquire various centres along the way with “gaps” in between, they are divided into sections (transects) exposing the changing nature of the conditions. Such a method may be relevant for the length of the analysed segment of the city centre.

Conditions of central grids have also been observed by Jacobs (1993), explaining that the appropriate distance between intersections for pedestrian and automobile use together is 80-100m, nevertheless in the case of an intensified pedestrian movement as the case of commercial city centres the distance is even shorter.

The morphologic analysis of the central structures will also be referring to conjectures of centres evolved in different periods of time under a different formative logic developed by Jiang and Peponis in Historic and Emerging Urban Centres in the Metropolitan Atlanta Region (2005), as well as by Jacobs (1993). Their differences were explained by distinctive evolution patterns. Historic centres develop from local to global, showing all the properties earlier mentioned as centrality process, while the new shopping or business centres start with the placement of a big scale element on a
globally well integrated line off movement, easy to reach yet not having an internal life. They behave as “non places”, “global connectivity versus local disconnection” affecting also the economy of the adjacent structures.

It was found that old centres have shorter lines, a wider variation of incidence angles, and smaller blocks than the new centres. Syntactic measurements established that old centres are better integrated locally then the emergent new ones, yet they may score lower in measurements of global integration as new thoroughfares are overlaid on the city structure for purposes of higher speed traffic. Describing the relation between their local and global position in the network, values of intelligibility and specially synergy and distinctivity (appendix A.6) are higher.

Newly emerging centres are characterised by constant awareness and continuity supported by wide angles of incidence. They are globally and locally less integrated and less well connected, scoring low in synergy values, though local intelligibility may be higher. Authors concluded that future transformation into a vital centre will only take place if the primary development is sacrificed.

Two more studies were found relevant for assessing the effects of the introduction of the civic centre. One is the doctoral thesis of Kavan Karimi (1998), comparatively analysing the process of change and growth of several English and Iranian historic cities. He describes the phenomena through which in Iranian cities the introduced alien grid dramatically changes the rest of the system, inducing the segregation of the old core globally and the termination of the traditional integration pattern locally.

Secondly, elaborating on the latest socialist interventions, Biljana Savic (1994) explains how socialist urbanism directed the spatial configuration of cities from an instrumental use where social necessity shaped the city, towards a symbolic use where ideology was reflected. She proves that if in an organically developed city spatial configuration had the essential role of providing a necessary basis for the functioning of the city as an economically sustainable centre, socialist modernizations caused a power relationship between centre and servant local structures, where the ideology is the force that overcomes space as generator of social interface.
Chapter 3: Morphologic and syntactic analysis of the various stages of development

The aim of this chapter will be to illustrate the structure of the city in the context of the previously presented theories, using methodologies from the Space Syntax area and outside of it. The hypothesis that Bucharest started from an Oriental structure and became more similar to European cities as it grew in size and underwent its various interventions will be proposed and tested.

The stages in the evolution of Bucharest will be analysed using a series of three maps. The first map dates from 1852\(^4\), the second represents the modernist period around 1935, before the great socialist systematization plans, and the last one is the most complete and recent record of the city from 1995 and it has not been changed until the present moment.

The axial maps\(^5\) of the three chosen plans of the city were investigated drawing out metric and syntactic properties of the city at different moments. The values were then compared to values gathered by Hillier et al., distinguishing models of urban settlements divided into different geographic regions, Asia, UK, Europe and US. It could be first noticed in Table 3.1 that the city has grown concentrically the structure becoming in the first period less dense which could be explained by its growth without boundary restrictions and inclusion of large gardens, parks and maidane and then it became denser again. Taking into account the presence of large empty plots and industrial developments inside the city area this phenomenon draws attention to the density of the new residential neighbourhoods.

<table>
<thead>
<tr>
<th></th>
<th>Axial lines</th>
<th>Surface (km²)</th>
<th>Density (lines/km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1852</td>
<td>975</td>
<td>14.3</td>
<td>69</td>
</tr>
<tr>
<td>1935</td>
<td>2,600</td>
<td>67.0</td>
<td>39</td>
</tr>
<tr>
<td>1995</td>
<td>10,000</td>
<td>192.5</td>
<td>52</td>
</tr>
</tbody>
</table>

Table 3.1

\(^4\) The 1852 map is the first map available at an analysable scale

\(^5\) For the axial modelling, the resolution taken into consideration was one that would be used on the older maps, bearing in mind limitations given by their scale.
Chapter 3: Morphologic and syntactic analysis of the various stages of development

Line length, angles of incidence and the distance between intersections (segment length) are as previously presented relevant metric properties to be investigated. Also block sizes, block numbers, intersection numbers are characteristics that will be proficient in placing the analysed structure in the discussed typologies.

The research shows that for the first step line length is increasing and it is decreasing again. This tendency might be explained by the fact that although longer axes were introduced by the intensive urbanisation, also the space occupied by the large socialist residential areas is very much broken up by labyrinthine and short lines. Meanwhile, the mean segment length (distance between intersections) is constantly increasing.

<table>
<thead>
<tr>
<th></th>
<th>Line length</th>
<th>Mean Segment length</th>
<th>Line length/segment length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min</td>
<td>max</td>
<td>mean</td>
</tr>
<tr>
<td>1852</td>
<td>15</td>
<td>825</td>
<td>121</td>
</tr>
<tr>
<td>1935</td>
<td>52</td>
<td>815</td>
<td>400</td>
</tr>
<tr>
<td>1995</td>
<td>12.16</td>
<td>5,365</td>
<td>242</td>
</tr>
</tbody>
</table>

Table 3.2. Metric properties of the axial maps of Bucharest in 1852, 1930, 1995.

Also it could be interesting to notice the changing pattern of the rapport between axial line length and segment length (right-hand column in Table 3.2). This measure indicates the mean value of segmentation of a line by intersections found on it. It suggests that previously the lines (streets) were more divided into segments that were generally shorter, while in recent times the lines are less divided, segments being almost the same size; each segment is almost a different axial step.

Looking at their pattern, longest lines were indeed in the oldest structure only a fraction of the radius of the settlement and mostly peripheral disposed, suggesting also a radial structure similarly to Asian cities described by Hillier (2001). In the next phase of development, much more similarly to European cities, the longest lines are approximating the radius and they are bordering discrete groups (fig. 3.1).
Fig. 3.1 Axial maps showing the longest lines on the maps of 1852, 1935, 1995
It can also be noticed that based on Hillier’s theory, the old city structure could be characterised as Oriental, since many intersections tend to be simple junctions, rather than crossroads as is the case of modern European cities (fig.3.2, fig.1.4). Also there is a much larger variety of angles of incidence at junctions in the old structure of the city than in its later extensions, emphasizing its orientality.

Next to the metric ones, syntactic measures were also processed. Examining the sequence of maps (fig. 3.3-3.5) it can be argued that the global centrality defined by the first range of highly integrated lines shifts in time from the princely court and trading centre towards the north, including the main boulevards created at the end of the 19th century as well as the most affluent promenade area of that period – Calea Victoriei. In the last phase the global centrality analysis highlights
the same boulevards, together with the socialist super-structure. This phenomenon can be recognised from Karimi’s report (1998) as the tendency of centres to shift towards the new axes of extension. The integration is distributed along the newly opened arteries either hosting representative functions (as the Civic Centre) or encircling micro-districts (especially in the SW), breaking the organically evolved shape of a “deformed wheel” (appendix A.8) described by Hillier (2001) (fig. 3.3). Furthermore, similarly to other socialist plans (Savic, 1993) sub-areas linked to an industrial plant, containing dormitories, communal facilities for recreation, education, health and commerce, are more segregated and less able to function as generators of local movement economies, working against planners intention.

As Karimi (1998) points out, the change is not only in the morphological shape but also in the spatial significance of the parts of the city to the rest of it, a phenomenon of “urban evisceration” (op cit, p.320), former integration cores having to rely on trans-spatial means of attraction.

*Fig. 3.3 Axial maps showing Global Integration patterns in 1852, picking in black the 10% most integrated lines*
Chapter 3: Morphologic and syntactic analysis of the various stages of development

Fig. 3.4 Axial maps showing Global Integration patterns in 1935, picking in black the 10% most integrated lines
Previously existing structure that shows conditions of grid densification and close to circular shape as explained by Hillier (2001) to be able to sustain a centrality process.

Integrated lines encircling residential neighborhoods, which are segregated, deep and do not have an internal structure able to sustain them as local centers.

Fig. 3.5 Axial maps showing present Global Integration pattern, picking in black the 10% most integrated lines
If the depth of the system could be suggested to be responsible for the labyrinthine understanding of Oriental cities, it should also be noticed that until the socialist interventions the configuration becomes shallower overall, reflecting as well an instrumental logic of growth explained by Savic (1993). With the new order and expansion of the socialist period the overall depth increases again, confirming the hypothesis of a symbolic ordering of space not meant to function on principles of economy of movement (as natural), but on prescriptive use of space.

Syntactic measures (table3.3) were compared to ones listed by Hillier in order to better differentiate between the various models. The extended table describing 68 cities that was examined is included in the appendix A.12, summarised by Hillier (2001), below.

<table>
<thead>
<tr>
<th>Year</th>
<th>conn</th>
<th>Int_RN</th>
<th>Int_RR(8)</th>
<th>Int_R3</th>
<th>Intelligibility</th>
<th>Synergy</th>
<th>Mean Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1852</td>
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<td>1</td>
<td>0.49</td>
<td>0.49</td>
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<td>Max</td>
<td>16</td>
<td>1.03</td>
<td>1.69</td>
<td>4.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>3.97</td>
<td>0.73</td>
<td>1.18</td>
<td>2.23</td>
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<td>SD</td>
<td>1.96</td>
<td>0.10</td>
<td>0.16</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CV</td>
<td>0.49</td>
<td>0.13</td>
<td>0.13</td>
<td>0.31</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6 SD = standard deviation
7 CV = coefficient of variation
In the graph in figure 3.7 values of Bucharest are compared to the average values shown in Hillier (2001). For the first phase global and local integration and connectivity values are increasing from figures lying between Asian and European cities, close to English town values, to figures higher then the average for the European cities. Therefore it can be suggested that the city has become in a first stage more accessible overall (less deep at the same time connectivity value raising) after the introduction of the axes that realise the connections East-West and North-South.

Also it can be put forward that at a local level, the system evolved to be more integrated/accessible, as shown by mean, minimum and maximum values, keeping its homogeneity while increasing in size as the coefficient of variation (appendix A.9) can show in the last row of the tables. This can be translated locally into the fact that the local integration values are spread, there are not too segregated, labyrinthine dead-end lines, or in other words it could be speculated that, the system is less hierarchical and as Hillier suggests more democratic.

Fig. 3.7 Evolution patterns of integration and connectivity values: Bucharest 1852, 1935, 1995
In the last stage the integration values decrease again. This could be explained by the fact that the added micro-districts are deep systems, therefore with low values of integration that pull down the values. The very well connected axes are connecting whole segregated districts that rely on them and communicate through in the system, as tree-like structures. It could be suggested that such a system actually contributes to greater areas being segregated, if we consider the improved maximum values given by few lines and the lower mean values, the performance is strongly influenced by a big number of lines in local areas that stay segregated. With very integrated a very segregated segments, both in global and local terms, it could be argued that it does not offer equal accessibility aimed by socialist ideology.

Fig. 3.8 Local integration map marking the segregated residential neighbourhoods/integrated links
Chapter 3: Morphologic and syntactic analysis of the various stages of development

When correlated to real built form (fig.3.9), it could be argued that a barrier of open space along the lines of the supergrid conceived mostly as traffic network, deepens the segregation, illustrating the picture of division and enclosure.

The study of location of activities on the oldest available maps (fig.3.10) shows that the commercial activities, market streets were the ones occupying prime "central" locations, and not symbolic elements as the religious establishments as parish
churches or Mitropolia\textsuperscript{8} as it could be expected contradicting previously considered theory organization of the medieval city of Harhoiu (1997). This characteristic could be found previously in Turkish Sarajevo or in Loumi’s Arab Cities (Savic, 1994) refuting the theory by which the central elements of Islamic cities are the religious symbols, exactly the theory that Harhoiu’s hypothesis relates to.

\textsuperscript{8} Mitropolia is the most important religious establishment having also an administrative role

\textit{Fig. 3.10 Location of activities on the integration map of Bucharest, 1852}
As mentioned earlier, in further development Calea Victoriei and the newly opened boulevards revealed as most integrated by the axial analysis were occupied by the banking sector and public spaces, proposing that as an instrumental space. Such a hypothesis could be further analysed if more precise land-use maps could be constructed according to written evidence, which was not possible in the time frame of this thesis and if proven correct support the proposal that the old city grew maximizing the spatial conditions for the functioning of the productive area of the city, using space instrumentally. Above and beyond, after the socialist urban interventions globally integrated locations would be occupied by representative functions (i.e. The Palace of the People, National Library or Ministries) suggesting a symbolic use of the space.

Trying to formulate a hypothesis regarding the evolution of Bucharest and its uncertain model of growth it might be concluded that characteristics of the spatial network have moved from a model in between Oriental and European cities (very close to UK cities) to the European model and then have abruptly lost the logical relation between the local and global scale of the system laying under the average of European cities. It is also remarkable that major changes appeared over a relatively short period of time with the operations realised in the 1980’s.

It could also be argued that the spatial configuration changed from an instrumental use, to a symbolic use, also confirmed by the location of different activities in relation to integration patterns.

The transformation at the central level, as well as the co-existence of inherited essentially dissimilar clusters will be further investigated in the following chapters.
Chapter 4. The relationship of the two central dissimilar urban networks

"At the crossroads is the meeting point, it is the place for quarrel, for polemic, for conflicts, for sacrifice, for ceremony, for party. [...] By the wall of the hospital, on the peculiar green field, the antique sellers chased by the authorities would like to set their market benches... The beggars recognise it as a privileged and profitable place [...] the blank wall of Coltea, random objects in arbitrary spaces, rushed cars, rushed people, nervous men waiting for the bus looking down, in noise, heat, dust, freezing cold, wind. It is the place at the crossroads. But is it also the centre of Bucharest?" (Celac, 1997, p.294).

Looking at the analysis undertaken in the previous chapter the "kilometre 0" of Bucharest described by Celac seems to be the integration centre of the street network. But the mixture of uses that a centre would be expected to gather around it are actually spread in clusters around the area.

From the perspective of the inhabitants, as students of one of the universities situated around the km 0, or the one of the tourists in search of the traditional representative centre of the city, the journey will pass through an arrangement of sequential experiences related to the spatial configurations. The situation that this chapter will attempt to explain is the magnitude and the implication of the change from one urban development pattern to another. In particular it will focus on the Civic Centre, major central intervention of the socialist urbanism, and the adjacent remaining of the historic core.

Fig. 4.1 The civic centre and the historic centre, immediately adjacent areas
Chapter 4. The relationship of the two central dissimilar urban networks

In 1980-1989 the last and most brutal intervention on Bucharest took place. Starting after the 1977 earthquake an area of 485 ha was demolished, approximately the size of two Parisian arrondisments, or the size of Venice.

Fig. 4.2 Picture of the demolished area of the central area: Piata Unirii, January 1985 (Harhoiu, 1997, p.10)

Fig. 4.3 Bucharest plan for systematization. In red is marked the area of the historic centre that was demolished for systematization.
One of the oldest and most picturesque neighbourhoods, over 20 of the parish churches, one cathedral, 9300 houses were replaced by an arbitrary axis meant only to emphasize the imposed totalitarian symbol and The Palace of the People (fig.4.2,4.3).

As acknowledged by Savic (1994) in the situation of most squares accompanying the main Party buildings all over Eastern Europe, the Civic Centre remains today an urban black hole, as it can be proved by maps adapted from the last census (fig.4.4). As an effect the scale and strong coherence of the historic structure were interrupted by the insertion of the gigantic ideological element represented by the Palace and the Socialist Victory Bd. (today Unirii Bd.) opening to it.
Between grandiose symbolic interventions and old urban forms there is naturally a great difference (fig.4.5). “It is not a requirement of grand boulevards that they be associated with social injustice although they imply hierarchy, and therefore produce a measure of imbalance between areas.” (Jacobs, 1993, p.36). The main concern of this chapter will be to capture and measure the degree of the phenomenon.

The remaining historic core of the city built on the ruins of the Princely Court of the 16th century occupies 52 ha out of which 28 ha represents the archaeological reservation. A maze of narrow streets and pedestrian passageways, bearing names linked to their historical and commercial past, defined by Calea Victoriei to the west, the Socialist Victory Boulevard to the south, The 30th December street to the north and 1848 Boulevard at the east (fig.1.5) is the area that is recently under vast operations of refurbishment meant to bring back if not the original structure of the city, at least its significance.

Most buildings date from the 19th century and many of them are in a state of disrepair, but their value resides in the fact that they symbolise the country’s
survival. Traditionally the buildings are brick structures clad with decorative elements with one, two or occasionally three stories, typically with commercial premises on the ground floor and spaces dedicated to residential functions on the upper floors.

As one walks through, there is an uncomfortable lack of space, almost no sidewalks or when they exist 1.5m wide and occupied by parked cars or recently by temporary structures taking advantage of the closing of the centre for automobile access. There are hardly any trees or green spaces, yet there are many opportunities to stop and rest, breaks on a narrow path, light and shades, acting as central structural elements.

![Image](image.png)

*Fig. 4.5 Sample of visual openings in the old centre*

Interesting, attractive perspectives are opening at each corner, diagonally cut corners accentuating this effect. Encouraged by the great diversity of frequent entrances alternating between residences, passages, shops or restaurants a very interesting relationship between public private domains can be noticed. Close communication, shouting from window to window, playground extended to any parking lot, street or any public space give the passer-by the feeling of a private courtyard.

One can experience unobstructed the privacy of the squatted residences\(^8\) through the gateway combined with shops selling antiques, shoes repair shops, old and

---

\(^8\) One of its many logistics problems (ownership, finances and organisation) is that it has been heavily squatted, bringing along major problems of crime and security. Around 4500 people of the most disadvantaged groups live here, many illegally, and that posed problems
very new furniture shops, a corner shop or just a stand in the middle of the road selling particular clothing items. But at the same time public spaces seem overtaken by the residents inviting you into their privacy.

Fig. 4.6 Illustration of the relation between private and public domain in the old centre

The typology of built form is to some extent modified by the presence of the river, bounded by representative buildings, as in the case of the “modernist” boulevards through and around the historic core. Save for the lack of more links over it and regardless of its unfriendly form (not including any leisure space) the urban form continues on the other side of the river. A combination of old and new morphologies in a similar composition with a feeling of fading vitality of commercial uses.

The atmosphere as well as the urban form end abruptly behind the high curtain blocks. Once one manages to get to one of the very few tight openings or to one of the edges of the boundary element a completely different perspective is opening.

The winding pedestrian or at the most one way streets, are replaced by a 6 lane, 3 km long avenue, limited by 10/12 storey buildings, at one end terminating with the great Palace and at the other at a large roundabout encircling a great car park and the unfinished reminder is probably one of the largest forests of idle tower cranes or rusting foundations to be seen. On the other side it may be found as in a mirror image, a similar variety of the old city.

The space can be observed without turning, without meandering, without breaks. Once on the axis the Palace draws everything towards it up to the point where the journey abruptly ends by the foot of the hill. Paradoxically although it is the only thing that can be seen from almost everywhere in and around the centre; it is not for the government’s redevelopment plan for which reason currently all are evacuated and
accessible, one cannot go any further. “The public edifice refuses the public scrutiny” (Celac, 1997).

The usefulness of the avenue as an east-west axis is clearly a valid argument looking at the constant traffic along it. Yet it’s identity as the “civic centre”, the representative boulevard can easily be doubted when looking at the pedestrian life it hosts. The commercial spaces at the ground floor of the tall residential buildings that define it seem to be constantly under refurbishment.

The kind of habitation is completely different to the one hidden in the back of it. No privacy is within reach anymore (fig.4.7(5)) and the grandiose public space is little more than a car park. Most of the passers-by have as a destination one of the offices along the avenue (convenient for the prime location from the point of view of commuting) or the public institutions at the end of it and the place shows its coldest face when the working hours are over. Children prefer playing “behind the block” a space in its own right. In order to visit the palace (which is a great touristy attraction), tourists are driven in coaches into the wide intersection/car park at the foot of it. Once the photographic opportunity is taken, the disoriented and dazed tourists are driven relocated.
back into the historic centre only 1 km away in a bird’s fly not being given a chance to rest, buy souvenirs, have lunch, generally consume a typical “centre” atmosphere. Of course there is no such thing to be taken advantage of.

Having portrayed the character of the two environments: the Civic Centre and the historic centre in opposition to their adjacency they are worlds apart and indeed they need to function together exploiting the socio-economical potential of both.
Chapter 5: Morphologic and syntactic analysis of the adjacent sections of the centre

As studied in the case of interventions on historic Iranian cities by Karimi (1998), sudden and aggressive addition of geometrical patterns can have the outcome of creating city sectors in formal and functional conflict with each other as previously described. Proposing as a reason the lack of integration between their grids, this chapter aims at analysing the civic centre in relation to the old centre relating it to conjectures previously developed by Jiang and Peponis (2005), Savic (1994) and Jacobs (1993).

The four-phased study is broken as follows: first it will briefly look comparatively at the morphological elements composing the avenue. Next it will concentrate on metric characteristics of the embedded system as urban block surfaces. Thirdly it will measure the difference between the visual experiences described in the previous chapter. And lastly the syntactic properties will be critically discussed on the background of the theories revised in the second chapter. Unlike in traditional historically evolved European cities, in cases where as argued social interaction was guided by ideologies overcoming natural, spatial laws, there is often an added imbalance of density and levels of attractors/services within a city which may be commented on though not included as a factor in the analysis.

5.1 Morphological analysis

If the success of the grand avenue is discussed, first the concept of a successful boulevard needs to be revised. The best streets and “grand streets” in particular, as Jacobs (1993) names them, are memorable, representative, comfortable, safe and encourage participation: either marches or other activities and they may have a specific setting that offers the potential for all this. “A boulevard is more than a wide street” though they evoke images of size and formality and are generally defined as broad landscaped thoroughfares. Centrally located their most important function is “to give structure and comprehension to the developing city” (Jacobs, 1993, p.35) linking important destinations they move large amounts of traffic at a rapid pace, as will be seen more to areas beyond than in the city centre in the analysed case. As places for enjoyment of the city pedestrians are probably the most important component of
successful boulevards. Therefore their affordance for walking at a leisure pace, with neither sense of overcrowding or being alone is important.

Giving a relevant background to the current argument Jacobs researches specific characteristics of a broad sample of boulevards such as Paseo de Gracia, Barcelona, Cours Mirabeau – Aix en Provence, Boulevard St. Michel, and Av. Champs-Elysées, Paris (Jacobs, 1993, p.75).

Jacobs shows that length can vary very much from 275m to 2km\textsuperscript{12}, yet he argues that it may be found difficult to maintain interest for long distances. Compared to those Unirii Boulevard is a 3.1km long street in a straight line.

With that in mind, the sizes and frequency of the facades are important issues. There is mainly one single façade repeated with minor variations. Transparency in another factor which contributes to the pedestrian experience. Space Syntax theory has shown the importance of the interface of the buildings to the street, coming to the conclusion that a combination of entrances and windows towards the street will benefit the interaction of the resident with the stranger passing by as well as the feeling of safety. A term of comparison was found again in Jacob’s Great Streets where he describes such streets as having doorways both to stores and private entrances at typically less than 7 metres apart; in addition, many of them contain pavement cafes and kiosks, adding to the street activity. On Unirii Bd. even though commercial premises were imagined on the ground floor these are almost all permanently under refurbishment or host particular functions, proving failure in attracting the public (fig.5.1.1).

Looking critically at the curtain-like facades against the multiple passageways and openings of the historic tissue, they do not satisfy any condition of permeability as described above. This will be shown in the analysis below.

\textsuperscript{12} Successful streets of Jacob’s sample (1997) come in a variety of sizes of 275m Via dei Giubbonari, 430m Cours Mirabeau, 500m Bd. St Michel, 1.6 km Paseo de Gracia, or 2km Champs-Elysées (nothing in Paris except maybe for the river Seine matching its scale) up to 3.2km Grand Canal.
Also the scale of elements is taken into account in the analysis below. The plans of several positive examples of avenues studied by Jacobs (1993) were compared to the plan of Unirii Bd. (fig.5.1.2), extracting referencing measurements. In Jacobs sample the boulevard widths range from 25.5 to 60 metres in comparison to which Unirii Bd. is 100 metres wide.
Not only the size but also the affordances of the streets are another requirement of a busy attractive place. Bd. Unirii is occupied in the middle by a 9m section of fountains that do not provide space for either resting or walking, not even crossing while the 15m wide spaces on either side of the roadway remain barren. The trees fulfil the role of shading the sideways but they are only present on half of the boulevard, towards the Palace of the People. One main element lacking is a service zone for the cars that are parked all along the street occupying one of the three lanes on each direction.

It could be argued that the problem lies in both what it exists and what is absent and more content is needed to create more human-scaled subspaces.

5.2 Metric properties of the grid

Next to geometrical properties of the street itself, how it is attached to the grid will be investigated. Streets which can be accessed at every 100m or even less in the case of a dense pedestrian activity were found to be easily reachable (Jacobs, 1993, p.302). Reversely in the case of the civic centre the intersections only occur at around 400–500m and even then the streets meet in large round-abouts and it takes even longer to meet the next possible destination (i.e. building entrance). Adding an extra layer to the problem it should be pointed out that the 400m frontages around the Palace are an un-constituted border, meaning that along it there are no entrances, nor windows and therefore no possible interface.

As part of the hypothesis that this paper laid down to test, the “mark of the golden age” is often compared to Haussmann’s large interventions in the 19th century Paris. With Haussmann a process of clarification and zoning is introduced together with a social hierarchy in a horizontally divided urban space. That is maybe the only valid comparison between the two interventions. In both cases there is a major transect, crossing through a large portion of the city; but as it will be shown, having a completely different relation with the regions it traverses.
Fig. 5.2.1 Comparative figure-ground maps (1 sq mile = 2.59 sq km) of segments of Champs Elysées and Unirii Boulevard – one closes off all intersecting old roads (the only passage being through a gangway-pedestrian only) while the other fully combines the two structures.

In a structured environment, Haussmann introduced a network of major axis nevertheless establishing a relationship of unity with the already existing tissue. Unlike in the case of the socialist interventions on Bucharest, a rigorous continuity of the urban fabric is maintained, resulting in much denser intersections. The junction between old and new is perfectly accomplished at the cost of the sizes and shapes of the footprint of the resulting blocks; rectangular blocks are divided into triangular slices without obtaining an un-interrupted uniformity in the Romanian manner.

The urban block is a compositional formal unit as well as a functional interface that needs to be well investigated and proportioned. Relations between urban form, theories and age were studied for the purpose of this analysis. Theories as Alain Jacobs’s as well as Bill Hillier’s assert that the scale of blocks and of street patterns has become larger with time, especially over the last 150 years, and with distance from the centre of the community. Compactness, density and intensity of the activities come together with it. A set of figure-ground maps was extracted from Jacobs, and compared to one built for Bucharest centre giving dimension to the differences (fig.5.2.2 and appendix A.13, A.14, A.15). Of course the size and region of the settlements plays an important role. A square mile of Venice, or Asian and Middle Eastern cities, represents almost the whole city and it is not comparable with a square mile of the centre of Brasilia. Nevertheless it can rarely be seen that the two adjacent urban areas of a same city are so dissimilar (table 5.2.1).
Chapter 5: Morphologic and syntactic analysis of adjacent sections of the centre

<table>
<thead>
<tr>
<th>Area (m²)</th>
<th>The whole structure</th>
<th>The new urban blocks</th>
<th>The historic urban blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>350.55</td>
<td>34.44</td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>124,099</td>
<td>8,661</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2,158</td>
<td>14,291</td>
<td>1,458</td>
</tr>
</tbody>
</table>

Table 5.2.1 Urban block sizes in central Bucharest

The blocks occupied by the Palace are about the size of the large office or commercial developments according to figures given by Jiang and Peponis (2005), or to maps shown by Jacobs (1997). Meanwhile the old centre is much more similar to the European medieval towns, which it once was.

![Fig. 5.2.2 Illustration of analysis of urban blocks according to size.](image)

The area between the centre and the south-west grid (marking in red high values) is short circuiting very sharply the system (historic core and residential area to S-W), not realising a smooth transition

According to the studied cases regarding the centrality of the new centres it was concluded by Jiang and Peponis (2005) that a logic of evolution applied equally to planned centrality and emergent metropolitan centrality, includes further fragmentation of the system. It could thus be concluded that a finer scale of the grid closer to the neighbouring central structure (and at the same time to previously revised examples of other cities) might be beneficial. Potentially new axes would improve accessibility, downscaling blocks as well as the cross section of the avenue.
5.3 Visual permeability conditions

The third aspect that was discussed in the previous chapter and needs to be objectively analysed is the range of visual experiences along routes in the old centre that abruptly and maybe problematically changes in the public area of the boulevard.

Areas of the 360° visual fields were drawn and calculated at each intersection on the big avenue as well as in the areas around it, on both sides of the street. A map was created colouring from red to blue the surfaces according to their size; a reduced sample is presented below in fig. 5.3.1. The results are also analysed and presented in table 5.3.1 proving a difference that seems to be easy to deal with in the case of the historic (medieval) core and the modernist interventions, but striking distance to the range of values for the civic centre. An acceptable rate of variance cannot necessarily be quantified, nevertheless such a great difference can be at least considered uncomfortable for the fluency of a journey.

<table>
<thead>
<tr>
<th>Isovist surface (m²)</th>
<th>Old centre</th>
<th>River bed</th>
<th>Civic centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>1,997</td>
<td>5,818</td>
<td>171,290</td>
</tr>
<tr>
<td>Max</td>
<td>15,029</td>
<td>70,089</td>
<td>594,192</td>
</tr>
<tr>
<td>Mean</td>
<td>6,017</td>
<td>19,271</td>
<td>444,718</td>
</tr>
</tbody>
</table>

Table 5.3.1 Visual fields sizes in central Bucharest

Secondly three equal distance routes were chosen along the Unirii Boulevard, main street of the historic core, Lipscani St., most representative of the
Chapter 5: Morphologic and syntactic analysis of adjacent sections of the centre

historic core, today still the most renowned and affluent street of the city, Calea Victoriei. For each one, all the visual fields opening at each intersection were drawn (fig. 5.3.2).

Just by looking at the resulting map it can be pointed out that the old urban tissue provides visual fields that are much narrower, and much more spread sideways through numerous tentacles, exhibiting 17 directions of sight sliding out the walking way against only 6 in the case of the socialist development. Same would probably be the case of other successful streets that the paper referred to up to this moment. This can probably explain the ability of a street to keep the passer by interested once it attracts him, an issue also raised previously in this chapter. And this interest can also be translated as other possible directions of movement.

Lastly, combining the two previous points, the density of axial lines that each isovist area intersects was calculated for the visual fields of each intersection drawn earlier. The strength of this measurements would lie in the fact that it can
describe the possibilities of movement that one can be attracted to once one is at a crossroad with no precise direction to take.

![Fig. 5.3.3 Overlay of visual fields with the axial map.](image)

The averages are calculated to 42 lines/42,257m² (1 line/1,000m²) for the area of the old centre compared to 13/180,313m² (1 line/13,870m²) for the isovists along Bd. Unirii, which could be interpreted as 13 times more directions (choices) are available (can be seen) along a same length walk or in an intersection in the medieval street system compared to the civic centre.

If the visual conditions along a path in the former civic centre were to become more similar to the ones in the much more active Calea Victoriei, it could be suggested that the areas covered by the visual fields should be reduced, closer to human scale, while the movement possibilities along a chosen route will need to be diversified, offering more choices of movement (intersecting more axial lines).
5.4 Syntactic characteristics

Distinctions in inter-settlement functional relationships, as the surviving historical hub and the uncompleted civic centre, may quantitatively be modelled, complementing economic geography, by a spatial network approach, proposing the analysis of syntactic properties, traditional in the Space Syntax analysis.

At a first processing of the entire axial map of Bucharest including its surrounding extents, outliers were detected standing out in local values (appendix A.16). They were identified as being the very long segments that were the only link to entire residential neighbourhoods. Bearing in mind that the main interest of this phase of the thesis is central network it was decided for the substantiality of the results to reduce the axial map analysed, according to standard procedures¹³.

First, both the global measures of axial and segment angular integration were investigated at a global scale illustrating the super-grid described in the third chapter as increasingly dominant, including the civic centre (appendix A.17). Though the segment based analysis shows decreasing values of integration on the segment towards Palace.

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¹³ An axial map is normally drawn at a min 2.5km radius around the area of interest, taking account of convexity of the map and natural limits
But the focus of this stage of the analysis will be its local embedding in the local system, also due to the fact that local properties may be more crucial to long-term efficient functioning of centres (Hillier, 1999). Syntactic analysis was previously able to show that historically evolved centrality and planned centrality are inherently different in many aspects. As the analysis illustrated in fig. 5.4.2 shows that the lines in the historically evolved centre are scoring much higher in local integration values than the lines included in the civic centre. In addition to this in the areas cut away to the south of the Unirii Bd., the local integration values decrease as well, the local structure is lost.

Fig. 5.4.2 Axial maps of central Bucharest before and after the socialist intervention of the 1980's showing the locally 10% most integrated axial lines.
As studied by Jiang and Peponis, 2005, often new centres started with a major element may serve certain types of functions that require a global interface, but they do not have a life as local centres. Therefore it can be considered similarly to large scale new developments as described by previously mentioned authors, and this may be an even more extreme case bearing in mind that it has no open public facilities.

Previous studies have shown that analysis of the catchment/influence area (appendix A.11) is relevant for supporting centrality processes through configuration Hillier (1999) or explaining the successful functioning of a place by values of integration Campos (1997). For the current case the catchment areas were determined according to a two step logic – two changes of direction or two step depth known in Space Syntax theory (Hillier, 1999) as a measure capable of approximating the influence area of a certain space, based on topological distance (fig. 5.4.3). The walking distance was marked (often used in planning strategies), which for the current case is only given as a visual reference\(^ {14} \). The investigation shows that although all areas are gravitating along highly integrated lines (in the first 10%) the 2 step deep catchment area of Bd. Unirii does not form almost any ringy systems of a convex shape close to a "spiky potato"\(^ {15} \). Even when only one ring is realised it is mostly a very wide one distance wise and therefore difficult to generate pedestrian movement. The only exception is the segment (transect) of the intersection with the north-south main axes (Piata Unirii), marked in fig. 5.4.3 a, which is indeed, as the photographic records show a busy, vibrant area.

Conversely, catchment areas of Calea Victoriei and the short Lipsanli St, main commercial spines through the historic quarter of the city are forming dense ringy structures all along (Fig. 5.4.3 b,c) and that provides a spatial explanation for their vitality and success. In the table 5.4.1 their densities may be compared concluding that the densest of all is the oldest structure, proposing as a reason that it is the most organically evolved, under movement economy, least modelled by later influences with distinct reasoning.

\(^{14}\) The walking distance is considered at a typical speed of 400m/5minute; for 5, 10, 15 minutes, and it is only shown radially "as crow flies" knowing that the catchment area may actually be smaller or larger depending on actual walking route and barriers of accessibility.

\(^{15}\) Refer to Chapter 2, p.15
Fig. 5.4.3 The catchment areas of Bd. Unirii (a), Calea Victoriei (b), and Lipsani St. (c) marking in red the most integrated 10% and radius of walkable distance generally considered 15 minutes (1,200 m)

Table 5.4.1 Densities of catchment areas

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<td>b</td>
<td>304</td>
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<tr>
<td>c</td>
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<td>1.32</td>
<td>50</td>
</tr>
</tbody>
</table>
Chapter 5: Morphologic and syntactic analysis of adjacent sections of the centre

Syntactical characteristics were analysed trying to discover syntactic differences between the systems defined by their catchment areas, as previous studies have explained successfulness by values of integration of lines (Campos1997). The table analysing syntactic values of the axial lines attached in the appendix did show only slight differences between the first two and again a greater distance to the oldest structure. Ending the analysis of the catchment areas, could be suggested maybe more relevant for the differences the syntactic analysis of the nodes/intersections found in the catchment area (fig.5.4.4-5.4.6). Though the results (Table 5.4.2) seem to fluctuate with the discussed pedestrian success, their consistency should be tested in later studies correlated to movement densities or detailed land-use maps.

Fig. 5.4.4 Overlay of catchment areas selecting the intersected nodes

Fig. 5.4.5 Local integration R3 of the nodes/intersections system
Chapter 5: Morphologic and syntactic analysis of adjacent sections of the centre

Fig. 5.4.6 Global integration RR of the nodes/intersections system

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<td>1.65</td>
<td>2.43</td>
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Table 5.4.2 Analysis of nodes caught in the catchment area

Taking into account that metric economy “seems to be the master property of centrality at all levels, though within a discipline initially imposed by a linear logic of urban space” (Hillier, 1999, p.19) a segment-angular analysis relative to metric walking distance\(^6\) could be suggested. With the scope of illustrating the areas which offer best conditions for (most often) shorter distance pedestrian movement, as reminded in the literature review it is strongly supported by Hillier’s recent favourable trials (2005) stating that though the newest of syntactic measurement methods it offers the strongest correlation to movement flows. The results point out again at the weak potential of the Civic Centre to generate pedestrian movement lines of it being in the lowest range of choice measure with the radius corresponding to 10 minutes walk (fig.5.4.7).
Chapter 5: Morphologic and syntactic analysis of adjacent sections of the centre

The global analysis has suggested that the oldest landmarks that were lost in the erasure of the area dedicated for the “civic centre operation” were essential not only for the dignity of the city, but also for its structure.

This affirmation can be supported by the comparison of measurements of intelligibility and synergy of the two adjacent schemes (fig. 5.4.8-5.4.10). The historic core is more intelligible as well as more distinctive as an area with an internal logic of its own. Moreover, even the characteristics of the old core seem to have decreased, compared to its previous state, with the introduction of the alien structure, interrupting it. This tendency is supported also by Karimi’s study (1989), which analysing similar superimpositions of systems on historic Iranian cities, concludes that it “not only changes the morphologic trends of the whole urban development, but also can degrade the spatial significance of the historic core as well as the relationship between the historic core and the rest of the city” (Karimi, 1989, p.320).

Since no references to numerical values were found in the literature and also due to limitations of the research space the tested method is illustrated only.
Chapter 5: Morphologic and syntactic analysis of adjacent sections of the centre

Fig. 5.4.8 Intelligibility plot marking the system inside the ring road the historic core before 1980’s

Fig. 5.4.9 Intelligibility plot of the area inside the ring road historic core after 1980’s (much lower than before) and of the Civic Centre lower than present of the historic core

Graphically, a full set of tested radiuses is attached in appendix.
In order to explain these tendencies a logic is proposed by Shokouhi (2003), correlating syntactic analysis with behavioural studies and mental maps was explored. It proposed that for the potential of an area to acquire a “group image” in a mental map, it is essential that it realises the continuity of locally high-integrated axes. Testing that, some highly integrated lines of movement are extended until they intersect a next local integrator across the boulevard and the second “border” – the river (fig. 5.4.11). Analysing comparatively the two present situation and the amended version it can be noticed that the distribution of the integration is gradually improved, bringing under more similar conditions the south and the north of the boulevard and increasing the values of local integration of the axial lines within the ring road.
The potential of local grid conditions would also be improved, more densified sections appearing along the presently isolated transect outlined by the Unirii Boulevard (fig. 5.4.12) which will account for a densification of functions and pedestrian movement.
Chapter 5: Morphologic and syntactic analysis of adjacent sections of the centre

Traditional syntactic values of mean connectivity, local and global integration, also increased and finally most importantly the interface between the local and global configuration of the system is improved (table 5.4.3).

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Table 5.4.3 Syntactic values for the present configuration and the amended version

The findings could support the proposal that the intelligibility and distinctivity of the system are also relaying on the continuity of the locally integrated routes and explained by their present interruption, adding thus another possible explanation to the poor performance.
Chapter 6. Conclusions and consequences on the potential development directions

The aim of the current study was primarily to offer a comprehensive spatial perspective of the transformations of Bucharest and of its resulting central and global configuration.

After having visited various conjectures of the evolution and current typology of the city and previously researched cases, it was proposed that different models were overlaid to the whole structure of the city causing a shift from a system comparable to Oriental cities, to a more structured, typically Occidental layout, with the aim of explaining the issue from a perspective of the whole system additional or against previous explanations based on architectural (or even urban) single elements.

Addressing the problem from a specific spatial point of view according to the typology based on syntactic measures developed by Hillier (2001) the research has ascertained that until the mid 20th century the city has evolved from a more irregular, deeper, organic structure in between Oriental and UK typology, towards a more organized configuration, shallower, more integrated and more intelligible than average traditional European cities. It was proposed that it might have been due to the modernist systematization works, introduction of boulevards integrating and connecting the city East to West and North to South.

Syntactic measurements then interestingly and very clearly revealed that the direction of evolution was shifted by a certain phase occurred in the second half of the 20th century, which has altered substantially the local and global spatial pattern. It was concluded that the last changes have severely decreased the internal logic of the city structure, bringing its intelligibility and coherence between local and global patterns to very low values again, out of the range of European cities. The reason for that was explained to be the introduction of a super-grid encircling segregated micro-systems, unable to connect with them in conditions that would create a local centrality.

With the constraints of the rough information available, the study of location of activities on the oldest available maps may also have implications contradicting previously considered theory of Harhoiu (1997) that the medieval city was organized around local centres represented by parish churches. With more precise
land-use analysis (not possible within the timeframe and space of this thesis) and on the background of previous cases it could be eventually suggested that the city transformed not only from one typology of city structure to another, but it also demonstrates in the last phase a shift from an instrumental use of space, driven by socio-economic (natural/organic) logic of either Oriental or Occidental cities to a symbolic use of space driven by ideological forces.

Further more, founded on the Hillier’s vision of the democratic city on the basis of relatively similar degree of integration in all its segments, and analytical methods proposed by Savic (1994) the variation of integration values was further investigated. Over time has showed a greater differentiation particularly of local integration values, which may suggest the loss of democratic value of the space and introduction of hierarchy, maybe supporting assumed dictatorial deployment of space.

In search for a thorough clarification of the problematic identity of the city and given the functional and configurational importance of the central articulation of an urban grid, the second objective was to explore the transformation at this level. It was proposed that the central structure also has lost its coherence with the introduction of the last socialist development (the Civic Centre) that may explain the current problematic state of the area.

The morphological analysis of the central areas of Bucharest reviewed in the 4th chapter allowed to extract many of the features which can summarize the (un)successfulness, difficulties and compatibility issues encountered by the Civic Centre. The analysis lead to distinguishing the subject from the neighbouring configurations and from models that it was easily and comfortably related to and even more, illustrated its similarity to other socialist spaces that “serve as an invisible boundary between the ordinary crowd and the untouchable leaders” (Savic, 1994, p.11).

Investigating individual spatial explanations the paper has shown that referring to metric properties blocks were too large compared to surrounding areas, and even by themselves alone compared to usual sizes and intersections not often enough to support pedestrian movement. Next, visual permeability was a key distinctive feature which may be accountable for the bypassing effect of the socialist intervention on the historic core. A syntactic analytic approach was proposed based on
Chapter 6. Conclusions and consequences on the potential development directions

Theories of centrality of Bill Hillier (1999). It was concluded that local grid conditions that would insure the functionality of a centre as the density (minimizing metric distance) and convexity of the two step deep catchment area were not satisfied by the socialist development, but they were certifying the successfulness of Calea Victoriei and the historic core of the city. Syntactic measures have additionally concurred to the diagnosis of un-intelligibility of the former civic centre and of the city centre as a whole.

Hence, it could be argued that after establishing the pattern of evolution of the city instrumentally grown into a very intelligible structure up to the stage of the socialist urbanism which completely shifted the use/function of spatial configuration, the second phase of the study focused on the effects of the 1980-1989 urban operation on the structure, function and identity of the central sector adjacent to the Unirii Boulevard confirming and explaining its problematic status set out in the third chapter.

The current study could generally suggest that the dis-functionalities of the system can be originated by the combination of segments that does not take advantage of the instrumentality of space in order to sustain social processes.

As it has been said, layouts that raise issues of intelligibility and local integration are imposing higher expenditure on resources and effort to overcome space, having implications on a city’s sustainability. In light of the present study and in the context of previously known concerns as the competition launched having as a subject the reintegration of the city centre (Bucharest 2000), it could be stated that the city’s structure needs to and could be improved and particularly, local strategies may be developed to support the global supergrid structure.

Briefly implications of the analysis were drawn at each stage as possible principles of “urban re-integration” of the 450 hectares of the central zone, stitching the city back again where previous interventions created an obstacle, reconstructing urban coherence, eventually required for re-establishing the economic and social potential of both of the areas of the Civic Centre as well as the historically evolved city core adjacent to it. Apart from that, an experiment was proposed to test the hypothesis that the distinctivity of a spatial configuration could be supported by extending through locally integrated axis, or explained by the lack of it. Supported by syntactic measures, it could be implied that such a strategy may be functional.
Building up on Space Syntax theory according to which spatial configurations are a reflection of social inputs, confirmed again by having the spatial analysis pointing out at configurational differences between structures that are recognised as belonging to distinct social ideologies, it could be stated that the logic of understanding and planning further urban transformations should be one negotiating the spatial network decisions explored by such studies.

Reflecting previous studies and generalizing the particular presented approaches, it could finally be proposed that retaining the historical legacy/information and including a desired Europeanization of the city could potentially be realized as a democratization of space which is described by Hillier to be “on the bases of large not small communities, dense not sparse local encounter spaces, non corresponding rather than corresponding social labels, and, above all, on the basis of an urban surface locally and globally open, distributed and unhierarchical” (Hanson and Hillier, 1984, p.268).
Appendix

A.1 **Axial map** is a method of representation composed of axial lines (implying meanings related to movement of a human body) of the continuous system of open space accessible to public, by the least and longest set of lines that traverse all the convex spaces.

A.2 **Global Integration** is one measure of the axial map analysis showing the degree to which each line is closer to every other line in the network (considering natural movement from everywhere to everywhere else) under the logic of the simplest route - minimum changes of directions.

A.3 A version of integration called local integration rad.3 restricts the measurement of routes from any line to only those that are up to two steps away from it. This measures the local importance of the space.

A.4 **Intelligibility** measures on a scale from 0 to 1 the information that can be inferred about a complex relational system from the locally available visual information. As described by Hillier, 1996, in represents “the relation between what cannot be seen and what is available”.

A.5 **Synergy** expresses the potential of the system to create an interface between the local movement and the global movement patterns. It can give information “about the quality of a neighbourhood, due to the predictability of the social environment, seen from the local point view” (Stegen, 1999). It can predict the potential of an interface of co-presence between local community and strangers, and that would be the raw material of social interaction.

A.6 **Distinctivity**, as synergy, concerns the local and global integration patterns. Plotting local integration versus global integration values, “the more the set of dark points (…)representing the lines of a particular sub area) forms a line crossing the regression line for the whole city, but tending to greater steepness, then the sub area is distinctive” (Hillier, 1996, p.174). A steeper regression line expresses the fact that the local integration pattern accounts for much of the variations of presence within the virtual community, in the conditions of poor differences between the global integration values of all the lines in the cluster. “A distinctive area is possessive, and makes it hard to the natural movement to escape towards other areas” (Stegen, 1999, p.7)

A.7 **The choice analysis** “computes the likelihood that each space in a spatial network is traversed for all potential movements on topologically simplest routes between all possible pairs of origin and destination spaces within the network” (Wai, 2005, p.325). Therefore it measures the potential of through movement of a certain space, as opposed to “to-movement” given by the integration measure. (Hillier et al. 1987; Peponis et al. 1989).

A.8 **Deformed wheel** is the type of integration core found in majority of organic cities analysed under the Space Syntax framework, where the inner most integrated lines form a deformed hub from which the integrated ‘spokes’ lead to different sections of the structure and the edges.
A.9 **The coefficient of variation** of a range of values is obtained by relativising the standard deviation of the values to the size of the sample by dividing it to the mean value, with the aim of finding a comparable figure between two samples of different sizes.

A.10 **The catchment area** of a space is the generally considered the area of most direct influence of a space regarding its movement pattern. In different documents it is considered either as a metric distance or topologic distance, and in the particular case of the current analysis is combining the two together for further investigation.

A.11 **Segment angular axial analysis** is a method of graph based analysis that uses as elements the segments between two intersections in the fewest and longest axial line map. It has the advantage of being able to differentiate between segments of the same line and weight the angular degree of direction changes as well and the length of the lines next to the traditionally measured number of changes of direction. Therefore it uses topological, geometric and metric distances in any combination.
### A.12 Syntactic measure of 68 cities

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<td>1.755</td>
<td>4.087</td>
</tr>
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<td>15 615</td>
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<td>2 519.3</td>
<td>2 519.3</td>
<td>1.929</td>
<td>956</td>
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<td>157</td>
<td>1.755</td>
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</tr>
<tr>
<td>Zagreb</td>
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<td>15 615</td>
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<td>2 519.3</td>
<td>2 519.3</td>
<td>1.929</td>
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<td>157</td>
<td>1.755</td>
<td>4.087</td>
</tr>
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<td>15 615</td>
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<td>2 519.3</td>
<td>2 519.3</td>
<td>1.929</td>
<td>956</td>
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<td>1.755</td>
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<td>Sofia</td>
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<td>15 615</td>
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<td>2 519.3</td>
<td>2 519.3</td>
<td>1.929</td>
<td>956</td>
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<td>157</td>
<td>1.755</td>
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<td>Thessalon</td>
<td>Europe/whole</td>
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<td>15 615</td>
<td>2 519.3</td>
<td>2 519.3</td>
<td>2 519.3</td>
<td>1.929</td>
<td>956</td>
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<td>157</td>
<td>1.755</td>
<td>4.087</td>
</tr>
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<td>Europe/whole</td>
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<td>15 615</td>
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<td>2 519.3</td>
<td>2 519.3</td>
<td>1.929</td>
<td>956</td>
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<td>157</td>
<td>1.755</td>
<td>4.087</td>
</tr>
<tr>
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<td>Europe/whole</td>
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<td>15 615</td>
<td>2 519.3</td>
<td>2 519.3</td>
<td>2 519.3</td>
<td>1.929</td>
<td>956</td>
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<td>157</td>
<td>1.755</td>
<td>4.087</td>
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</table>

The sequential development and the consequent urban patterns of Bucharest
The sequential development and the consequent urban patterns of Bucharest

A.13  Jacobs, 1993, figure-ground maps 1 sq. mile = 2.59 sq km
The sequential development and the consequent urban patterns of Bucharest

A.14 Bucharest figure-ground maps 1 sq. mile = 2.59 sq km

The Palace of the People, Civic Centre Area

The historic core
A.15 Jacobs, 1993, p.262

<table>
<thead>
<tr>
<th>City (and area or date)</th>
<th>Intersections</th>
<th>Blocks</th>
<th>Distances between Intersections (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Venice</td>
<td>1,725* (1,507)</td>
<td>987* (862)</td>
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</tr>
<tr>
<td>Ahmcdabad</td>
<td>1,447</td>
<td>539</td>
<td></td>
</tr>
<tr>
<td>Tokyo (Nihonbashi)</td>
<td>988</td>
<td>675</td>
<td></td>
</tr>
<tr>
<td>Cairo</td>
<td>894</td>
<td>301</td>
<td></td>
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<tr>
<td>Old Delhi</td>
<td>833</td>
<td>244</td>
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</tr>
<tr>
<td>Seoul</td>
<td>718</td>
<td>496</td>
<td></td>
</tr>
<tr>
<td>Boston (1895)</td>
<td>618* (433)</td>
<td>394* (276)</td>
<td>190</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>578</td>
<td>305</td>
<td></td>
</tr>
<tr>
<td>Savannah</td>
<td>530</td>
<td>399</td>
<td></td>
</tr>
<tr>
<td>Boston (1955)</td>
<td>508* (356)</td>
<td>342* (240)</td>
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<tr>
<td>Rome</td>
<td>504</td>
<td>419</td>
<td>198</td>
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<td>Barcelona (Ramblas)</td>
<td>486</td>
<td>330</td>
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<tr>
<td>London (City)</td>
<td>482* (423)</td>
<td>296* (259)</td>
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</tr>
<tr>
<td>Zurich (1985)</td>
<td>425</td>
<td>275</td>
<td></td>
</tr>
<tr>
<td>London (Mayfair)</td>
<td>423</td>
<td>273</td>
<td></td>
</tr>
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<td>Bologna (center)</td>
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<td>272</td>
<td>224</td>
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<tr>
<td>Paris (Louvre)</td>
<td>416</td>
<td>315</td>
<td>245</td>
</tr>
<tr>
<td>Boston (1980)</td>
<td>373* (261)</td>
<td>245* (172)</td>
<td>235</td>
</tr>
<tr>
<td>Portland</td>
<td>370* (351)</td>
<td>318* (302)</td>
<td></td>
</tr>
<tr>
<td>Zurich (1890)</td>
<td>369</td>
<td>243</td>
<td></td>
</tr>
<tr>
<td>Aix-en-Provence</td>
<td>362</td>
<td>233</td>
<td></td>
</tr>
<tr>
<td>Pompei</td>
<td>347* (151)</td>
<td>246* (167)</td>
<td>224</td>
</tr>
<tr>
<td>New York (Lower Manhattan)</td>
<td>339* (218)</td>
<td>275* (177)</td>
<td>274</td>
</tr>
<tr>
<td>Toulouse</td>
<td>331</td>
<td>242</td>
<td></td>
</tr>
<tr>
<td>San Francisco (center)</td>
<td>293* (274)</td>
<td>216* (202)</td>
<td>353</td>
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<tr>
<td>Paris (Etoile-Rond-Point)</td>
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<td>214</td>
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<tr>
<td>Pittsburgh (center)</td>
<td>277* (143)</td>
<td>197* (124)</td>
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<tr>
<td>Copenhagen</td>
<td>244</td>
<td>170</td>
<td></td>
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<tr>
<td>Pittsburgh (Shadyside)</td>
<td>242</td>
<td>188</td>
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<tr>
<td>Oakland (center)</td>
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<td>153</td>
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<tr>
<td>Santa Monica, CA</td>
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<td>147</td>
<td></td>
</tr>
<tr>
<td>San Francisco (mid-city)</td>
<td>182</td>
<td>137</td>
<td>409</td>
</tr>
<tr>
<td>New York (Midtown)</td>
<td>181* (159)</td>
<td>166* (146)</td>
<td>423</td>
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<tr>
<td>Santa Cruz, CA (center)</td>
<td>179</td>
<td>106</td>
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<tr>
<td>Los Angeles (center)</td>
<td>171</td>
<td>132</td>
<td>390</td>
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<tr>
<td>Barcelona (Paseo de Gracia)</td>
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<td>138</td>
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<tr>
<td>San Francisco (Sunset)</td>
<td>161* (131)</td>
<td>130* (106)</td>
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<td>Bologna (Corticello)</td>
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<td>Washington, DC</td>
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<td>122</td>
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<tr>
<td>Toulouse-Le-Mirail</td>
<td>146</td>
<td>112</td>
<td></td>
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<tr>
<td>Irvine, CA (residential area)</td>
<td>119</td>
<td>43</td>
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<tr>
<td>Walnut Creek, CA (center)</td>
<td>116</td>
<td>64</td>
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<tr>
<td>Walnut Creek, CA (2.5 m from center)</td>
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<tr>
<td>Brasilia</td>
<td>92</td>
<td>47</td>
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<tr>
<td>Los Angeles (San Fernando area)</td>
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<td>47</td>
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<tr>
<td>Irvine, CA (business complex)</td>
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<td>17</td>
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</table>
The sequential development and the consequent urban patterns of Bucharest

A.16 Axial map of Bucharest marking the outliers and the analysed area

A.17 Axial map of Bucharest measuring global integration RR7
The sequential development and the consequent urban patterns of Bucharest

A.18 Table showing syntactic measurements of the three different catchment areas

<table>
<thead>
<tr>
<th>Int R3</th>
<th>a. Unirii Boulevard</th>
<th>b. Calea Victoriei</th>
<th>c. Liscani Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>1.65</td>
<td>0.5</td>
<td>1.74</td>
</tr>
<tr>
<td>Max</td>
<td>6.38</td>
<td>7.05</td>
<td>7.05</td>
</tr>
<tr>
<td>Mean</td>
<td>3.51</td>
<td>3.54</td>
<td>3.46</td>
</tr>
<tr>
<td>SD</td>
<td>0.83</td>
<td>0.97</td>
<td>1.07</td>
</tr>
<tr>
<td>Int RN</td>
<td>Min</td>
<td>1.27</td>
<td>1.10</td>
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<tr>
<td>Max</td>
<td>1.69</td>
<td>1.73</td>
<td>1.73</td>
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<tr>
<td>Mean</td>
<td>1.43</td>
<td>1.36</td>
<td>1.40</td>
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<tr>
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<td>Int RR7</td>
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<td>2.59</td>
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<tr>
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<td>2.00</td>
<td>2.05</td>
<td>2.02</td>
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<tr>
<td>SD</td>
<td>0.15</td>
<td>0.17</td>
<td>0.18</td>
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</table>
A.19 Segment map of Bucharest measuring angular choice at different radiuses
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Bibliography:


- Celac M., 1997, *Pe latura dinspre Dambovita a curtilor Casei Poporului, Bucharest*, 20th Century, Union of Romanian Writers, Bucharest;

- Harhoiu, D, Bucharest, 1997, *A City Between Orient and Occident*, Simetria, UAR and Arcub, Bucharest;


- Karimi, Kayvan, 1998, *Continuity and change in old cities an analytical investigation of the spatial structure in Iranian and English historic cities before and after modernisation*, University College London, London;

- Karimi K, Mavridou M, Armstrong M, 2005, *Understanding cities through the analysis of their prime activity axes: The capital routes*, in
The sequential development and the consequent urban patterns of Bucharest

Proceedings of the 3rd International Space Syntax Symposium, University College London

- Savic B, 1994, *Sarajevo: changing role of urban space*, University College London
- www.arch.columbia.edu/Studio/Spring2004/UD