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Research Article

THE FRACTAL ANALYSIS, AN ALTERNATIVE TO THE RENEWAL OF URBAN LAND IN THE BEJAIA CITY

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ABSTRACT

The aims of the present study are to evaluate and characterize the spatio-temporal dynamics of urban spaces in bejaia city northeastern Algeria. In this work, we use the allometric scaling associated with fractal model and geographic information systems to solve the mentioned problem. The analyses of results show that during the period 1947 and 2019, the structure of the study area indicates a notable deep dilution with irregularity in the size and shape ($D_{surf\ 1947}$ = 1.75, $D_{surf\ 1985}$ = 1.58 and $D_{surf\ 2019}$ = 1.71) due to the decrease in the area of agricultural land and forests. The results of fractal model analysis showed that over time the spatial distribution of urban area becomes more complex and clustered. On the other hand, the results demonstrated that the spatial and temporal evolution of the urban area goes from a compact (a_{1947}=1.80) to diluted city (a_{2019}=1.27). Finally, the results of this study can be used as a decision-making tool for analyzing complexity of the spatio-temporal variation of urban areas and assisted decision-makers to take an action on land management.

Keywords: Urban sprawl; fractal; dilution; urban spot; Bejaia.

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1. INTRODUCTION

Sustainability stems from the existence of an everlasting struggle between mankind and the earth (Hao Wang et al 2013). Our cities are ever expanding and diluted. The importance and necessity of demand for any sort of land use is progressively greater than the land resources available. Through rapid urbanization and population development, man is trampling on environmental, social, and economic laws. The result is an urban spill (Sara reux, 2014) and a diluted urban system; similar to an amorphous, fragmented (volcano) eruption. This Urban System dilution is similar to allometric development, which appears to be a model of scale that emerges from a dynamic evolution (Yanguang Chen et al 2019). As has already been demonstrated by many authors, such as Clark or Bussière and Stovall, urban systems are far from being distributed equally. A city is a kind of self-organized system that creates urban disorder (Yanguang Chen et al 2019). To order to reconstruct the city sustainably, focus is placed on the study of morphological processes to urban space creation (Pouyanne, 2014; Sara reux, 2014). Studying city morphology can help to discern the presence of notions of order. As for spatial phenomena, the approach to fractal geometry seems fitting to enhance the geometric perception of urban spaces. Fractal geometry is a paradigm for explaining the urban morphology; formalizing the macroform description of the space we live in. Used in various disciplines such as turbulence dynamics, diffusion processes or dielectric breakdown phenomena but also in the study of biology and texture.

This type of geometry will help us understand complex forms, discern the building's diffusion, demonstrate the key axes of urbanization and the path and structure of the urbanization. Fractal geometry was born thanks to Benoit Mandelbrot's research (Mandelbrot 1983), which focuses on objects with similarities in structure. From the beginning, starting with the field of geography, this modern concept of objects and their relationships was introduced and used, more specifically in coastal research. The work of the following researchers is another impressive contribution to the field of Pierre Frankhauser, which started in 1991: Cyrille Genre-Grandpierre (Frankhauser et Genre-Grandpierre 1998), Jean-Philippe Antoni (Antoni 2001), Cécile Tannier and Gilles Vuidel (Tannier, Vuidel & Frankhauser 2008), Lilian Cîrnu (2014) and Claudia Yamu and Akkelies van Nes (2017). The relentless evolution of land uses changes urban space morphology and is not dissociated from the process of urban growth and transformation. Artificialization of soils guides territories into a significant modification of their urban structures, giving rise to various models and types of urban spatial growth and macro forms (Allain and All, 2004). Therefore, from the point of view of urban dilution, the urban shape is analysed; this process can be quantified by urban spot research.

In this analysis we are interested in using mathematical models, scales of allometric relationships and parameters of the fractal formula. We will define and examine the space in real world city systems through and changing. Not for reasons of academic interest, the city retrospective conference is intended to define and analyze the essence of the city structure and the dialectics of its development history. Through the study of the city's urban location, fractal analysis will lead us to elaborate the expansion laws and reveal the main axes of dilution of urban spaces, their direction and form. To determine the degree to which urban spaces (soils) are built and viewed by stakeholders, technical soil analysis is useful in bringing changes in land use on many contextual and temporal scales into perspective. The temporal cycle of an urban system refers not only to a distribution of the size (Batty M, et al.1994.), but also to a spatial distribution (Yanguang Chen 2019). This article is devoted to exploring fractal parameters based on the urban morphology growth and dilution. The rest of the

Article is structured according to. Section 2 presents a series of models on fractal analysis of urban type and related models of fractal dimensions, and shows the relationships of the fractal dimension. In section 3, empirical analyzes of fractal structure based on variable urban and radial fractal diagrams and maps are performed by examining the city of Bejaia at different times 1947; 1985 and 2019. Section 4 addresses relevant topics, and shows the relation of fractal dimensions with spatial forms. Lastly, the review ends with a description of the key points of this work.

2. METHOD

2.1 Fractals

The fractal dimension lets urban fabrics be defined, analyzed and categorized. The city's fractal analysis presuppositions are based on a theoretical view of the town as a complex structure."Its fractal dimension, called **D**, is one of the main characteristics of any fractal struc ture. It tests its degree of irregularity and rupture" (Mandelbrot, 1975). By studying their surfaces and urban borders and using a number of morphic descriptors including degree of homogeneity, axial hierarchy, complexity, compactness, dendricity, and roughness. (Batty and Longley 1994; Frankhauser 1994, 1997, 1998, 2002, 2003, 2005; Dekeersmaecker et al. 2004; Badariotti 2003, 2005; Tannier 2010, 2011). It also enables urban fabric typology to be produced based on fractal reference models such as the Sierpinski carpet, Fournier dust, and terragone. The aim is to use geometric objects and elements of a given size to cover the structure in question (e.g. simple length squares **ε**). And decide on the minimum number of these objects, which is necessary to cover the entire structure. According to Mandelbrot (1982) the fractal dimension **D** for iteratively constructed fractals is defined by the following relationship.

According to Frankhauser (2003), in the following form which includes the two parameters **a** and **c**, a generalized fractal law N (ε) may be implemented.

$$N(\varepsilon) = a \times \varepsilon\text{-}D + c$$

Where: **a** is a constant called the form factor. This characterizes the object's general shape and scale, but also applies to deviations from fractal laws. Mathematically, at last, it is the object's dimension. "**C**" is a parameter which allows the fractal curve to fit better by removing the fractal ruler deviations commonly found for the distances of the building scale.

2.2 Various analyses of the fractal geometry

Taking up the theoretical approach of Pierre Frankhauser; demonstrated in his doctoral thesis, published in 1994, "The fractality of urban structures" In the study of urban architecture it explains the principles of the implementation of models unique to physics. The following parameter equations allow us to estimate the fractal dimensions and the ratio of the various fractal dimensions of the urban form.

Correlation analysis: A correlation study is a global indicator of fractality within an image. The definition of which is as follows: all pixels are surrounded on a matrix image of the ground surface by a square window of size ε. Then an exponential curve is obtained with the ε and M (ε) co-ordinates. We opt for a linearization of the logarithm and the relationship is in the form of: $\text{Log } N(\varepsilon) = L + D\log(\varepsilon)$

We will then extract D; it corresponds to the slope of the line of adjustment and will then be used to calculate the expected curve; this is a theoretical construction made from the calculation D. Parameter L is a constant which corresponds to the pre-factor of a form. This work will be used later for the study of eroded surfaces and borders.

Radial analysis and the scaling behavior: The radial analysis that transcribes the structure of the Space inside a selected counting center and is therefore a local analysis. Express the differences in local fractality in the form of a scaling behavior curve.

Expansion (dilation) analysis: This analysis removes both the boundaries of aggregates and the boundaries of surfaces. It allows us to form a single aggregate, with a clear boundary, over many stages of development. Replacing the empty spaces of an urban environment in multiple iteration stages by dilating the previously filled squares. This helps to clear out empty spaces and replace them with aggregates. Such aggregates are combined in iteration phases.

2.3 Morphic identity indicators

In addition to the broad range of analytical approaches, fractal geometry provides a multitude of markers for urban tissue classification and morphic identity measurement. The measures used here for the morphological analysis of BEJAIA's urban structure according to the different periods are:

The degree of surface homogeneity **(D_{surf}):** by measuring the fractal dimension of correlation D, it provides information on the homogeneity or heterogeneity of the distribution of the constructed spaces.

The degree of hierarchy: It offers information on the hierarchy of the Built Spaces distribution by measuring the fractal dimension of the correlation D.

The degree of complexity **(a)**: It offers information on the complexity of the fabric that was studied by calculating the "a" type factor the higher the value, the more complex and the more lightweight the fabric.

The degree of compactness **(N):** This gives descriptions of the tissue's compactness or density by the number of iterations resulting from the dilation measurement.

The degree of border homogeneity **(D_{bord})**: This gives us knowledge of the homogeneity or heterogeneity of the urban boundaries by calculating the fractal aspect of the boundary correlation "D_{bord}."

The degree of dendricity **(δ):** It gives us information on dendricity of the urban borders and tortuosity of fabric. It represents the relationship between the mass being constructed and the boundary, and the way it is used.

The degree of roughness (**Is**): It provides information on the roughness of the urban fabric through the "Is" synthetic roughness index. It calculates the difference between Dsurf and Dimension 2 and Dbord to Dimension 1.

$$Is = (2 – Dsurf) – (1 – Dbord)$$

For intra-urban space, tissues with a smoother border often show greater fragmentation, whereas tissues with a very tortuous border are more compact on the inside. This becomes apparent when considering the two metrics, the index of dendricity and the index of fragmentation φ (see Table 2). Recall that for a Euclidean figure $\delta = 0$ while for the Sierpinski carpet it achieves its maximum value $\delta = 1$. φ also varies between zero and one, the minimum value corresponds to a single Euclidean object (such as a square) and $\varphi = 1$ characterizes a structure comprising many aggregates of different sizes, but with smooth edges of each.

3. EMPIRICAL RESULTS

3.1 georaphic situation of the study area

One of the first-order Algerian coastal cities, Bejaia, by local name Bgayet, in French Bougie, is situated in the western part of the southern fringe of the Mediterranean geographical region, which occupies the center of North Africa's coastal strip. Leaning against Mount Gouraya's southern flank, the city is set with a regional morphology, like an amphitheatre. Thus the site provides natural security and an opportunity for defense that justified the establishment of this large-scale settlement. The Bejaia Wilaya occupies an area of 3,223.5 km, covering an area of 12,022 hectares, the urban area of which is. The geographical coordinates of the municipality are 36 ° 45 ′ 00′ ′ North and 5 ° 04 ′ 00′ ′ East respectively at the central point of its capital. Also, the province is at the meeting of a circulation and transportation network with great flow efficiency. A relatively dense road, motorway, and railway network serves it. Bejaia holds the burden of history and the legs of a heavy past marked by a mixture of modern cloth, ancient fabric; colonial and post-colonial fabric arising from a multitude of remaining civilizations.

3.2 Material and method

The above models could be applied as a case study on the city of bejaia. Located in the eastern coastal regions of Algiers. The data sets were extracted from the urban maps of this city for the years 1947, 1987 and 2019.

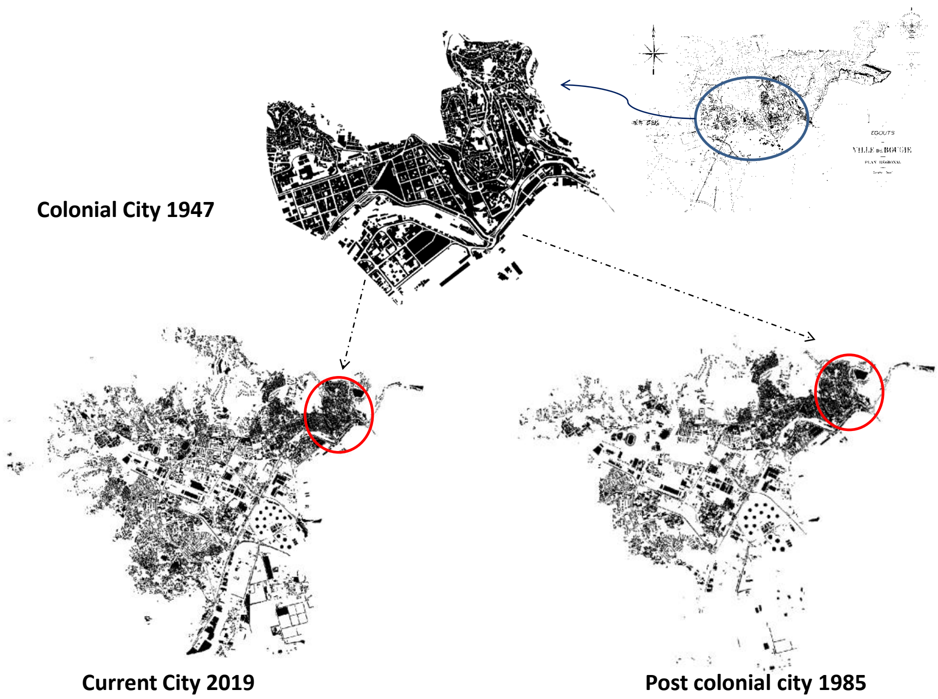

Fig.1. maps of Bejaia city for the years 1947, 1987 and 2019

Source: authors 2019

The data was collected using the ArcInfo methodology and analyzed there. For this analysis the maps used for these urban fabrics are taken from satellite images and cadastral surveys at a scale of 1:5000. First, the maps of the urban system have to be digitized according to the steps below. Step 1: Those two databases were georeferenced under ArcInfo. Step 2: Out of the "constituted" sheet. Step 3; then taken over, processed and rasterized in uncompressed format (* .tiff) and binary images. Step 4: Generating a map. Analysis of the morphological evolution of the city of BEJAIA as a corpus; analyzes urban fractalities and structures. Under the leadership of Pierre Frankhauser, we used Gilles Vuidel's (2002-2003) fractalysis method. At the laboratories, behind the Matlab programming language: CNRS ThéMA, Besançon (France) and Image and City of Strasbourg (France).

This tool has a wide array of analytical methods which make it important to our research. By studying the scaling behaviour curve (Frankhauser, 1994), mainly for comparison correlation analysis and radial analysis to investigate the variance of fractality within the region.

Then, based on the analyzes above; the maps are entered on the program for fractal analysis. A description of an urban macro-shape, i.e., a city's silhouette, should be defined by type indices. Taking into account an urban morphology, it is possible to preserve three steps, namely the urban area, urban boundaries and natural and man-made components. Every research period in The Urban Area has been systematically measured and reported with the plan. Through the correlation analysis we were able to assess the city planning characteristics over three phases and deduce their degrees of hierarchical homogeneity and compactness. Ultimately, it is possible to see that the major structural discontinuities of the agglomeration we described above are brought out by radial fractal analyzes. The dilation analysis tells the degree of compactness of the tissue by the number of iterations needed for its total dilation. A collection of spatial measurement data will be obtained for each time of evolution of the region, based on the variables (see attached tables).

3.3 Results

Using the datasets of the fractal measurements of the city of bejaia's three phases of evolution based on curves of evolution and dilution of the urban space of variable urban boundaries, we can show the spatial relationships between the different structures. Then we can study the dilution and macroform relations between the different periods by mea suring the degree of complexity (a), The degree of border homogeneity (Dbord), The degree of roughness (Is) ect.

3.3.1 Correlation analysis results

a. The degree of homogeneity and hierarchy in urban tissue: Determines the similarity between the units that make up it. The curves of the scaling behavior allow understanding of the structure of the frame and measuring the homogeneity of its distribution. Therefore, they have the ability to differentiate the tissues being studied.

In our case, the values of the differentiated fractal correlation dimensions vary from 1. 75 for the 1947 period, 1.58 for the 1985 to 1. 71 for 2019. That said, the tissue of the town of Bejaia reflecting the colonial system strongly converged fractal dimensions at the maximum value in 1947 (1.75), indicating a similarity of the historical core constituent units at that time. The city at that time was well-mastered, and Hierarchical. The scaling conduct curve offers a built hierarchical framework that blends in with the same crown. Characterized by the homogenization and composition of urban contexts in which industrial and agricultural land is designed and controlled. Squares and streets described the town as stable and observable. Next comes the "Bejaïa in 1985," less homogeneous, characterized by a less large (1.58) fractal dimension. With a less homogeneous fabric which lacks an urban fabric similarity. From a previous bejaia state, they needed to expand in space to meet population needs and rural exodus; what caused these extensions. The scaling conduct curve shows the town fabric in 1985 had a less hierarchical morphology. The absence of undeveloped spaces, this period was characterized by the city's densification without taking into account the square and street elements; so, let's forget the urban aesthetics. A sort of destabilization by crossing land boundaries and using them for agricultural purposes, and facing regulatory constraints: Gouraya National Park and coastal defense. Finally, "Bejaïa in 2019" also contrasts. It has an elevated fractal dimension (1. 71), and is relatively homogeneous. Bejaia, according to its current fabric, is merely the product of complex stratification. The effect is the overlay of many historical layers and multiple interventions, as well as the spontaneous ecosystem emerging in force to destabilize its course. In the case of planning instruments, the city faces several criteria; is spatially constrained and faces densification and compliance with the rules. So, a morphology structure which is more hierarchical. The curve of scaling behavior reveals variations (fluctuations) that fit undeveloped spaces that hierarchize the tissue. The holes or undeveloped spaces however are far from highly dynamic spaces. On the other hand, the fractal surface dimensions of the various tissues studied show a positive correlation where a value of r = 0.99 is given.

Figures 2 and 3 illustrate scaling activity curves from an analysis of the correlation of urban tissue bejaia over different periods of time.

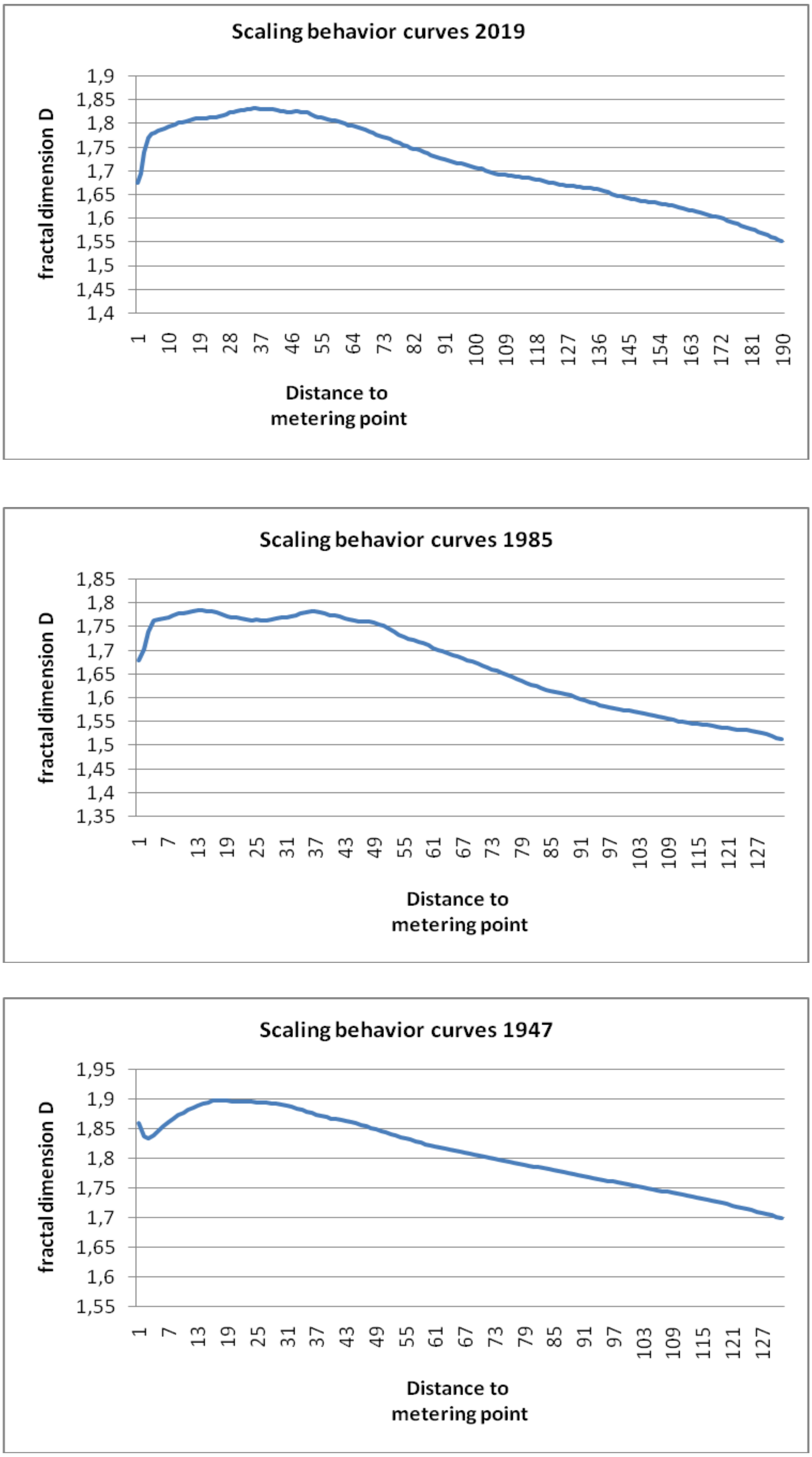

Fig.2. Scaling behavior curves of the correlation analysis

Source: authors 2019

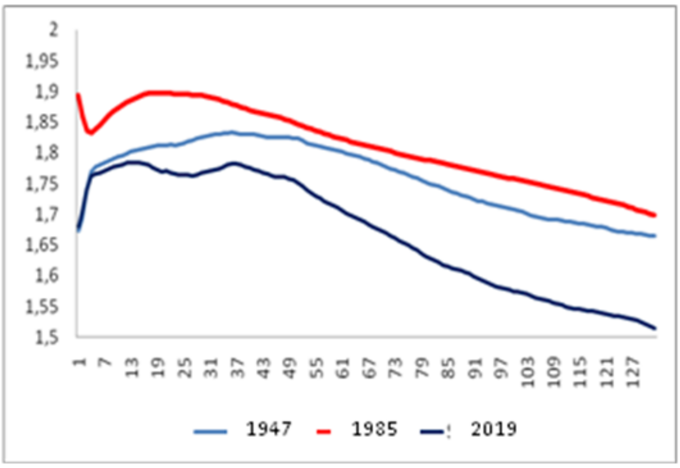

Fig.3. Comparison of scaling behavior curves of correlation analysis
Source : authors 2019

The curves of the scaling activity resulting from the Surface Correlation analysis are moving in the same direction and following the same trend. But this situation does not mean the morph similarity of the two tissues being analyzed. Since the morph information provided is global information resulting from a global analysis (fractal correlation analysis) that provides the average of all the tissue being analyzed.

b. The degree of complexity of the tissues

The "a" form factor says about how complex the tissues are. For the tissues that concern us, the value of 'a' for postcolonial (1985) and latest 2019 colonial (1947) fabrics is 1.802, 2.216 and 1.277 respectively. It describes the irregularity in the size and shape of the units that form the urban 'island' structure. Complexity classification has a direct relation to the degree of heterogeneity as shown in Table 1.

Table1. summary of the shape index, Source: authors

	1947		1985		2019	
Fractality index D	Homogeneous	D=1.75	heterogeneous	D=1.58	Homogeneous	D=1.71
Form factor a	Complex	a=1.80	Very complex	a=2.21	Less complex	a=1.27
results	Homogeneous, hierarchically moderately complex.		Heterogeneous, nonhierarchical, very complex.		Homogeneous, hierarchical, less complex.	

Colonial cloth (1947) with a medium complexity and hierarchical homogeneity. This complexity is reflected by the irregular division of the islands, due to the form of the sloping city (uneven terrain). Hence the urban cloth and cloth cutting in triangular islands and the layout of the checkerboard. Postcolonial structure (1985) characterized by non-hierarchical heterogeneity, which is very complex. This challenge is demonstrated by cutting the islets anarchically. A multitude of fabrics are present, namely the industrial activity zone, which occupies a very significant urban area. The structure of the current city (2019) is characterized by homogeneous, hierarchical and less complex morphic descriptors. The city is getting denser from all over the city. We are witnessing the emergence of a very dense spontaneous urban system with or without planning; and filling every empty lot with gaps within the city.

Radial analysis:

When analyzing the scaling behavior curve for the entire agglomeration (Figure 4) with a localized count point, major breaks are observed in the decline in fractality towards the periphery in the middle. We find irregularities (gaps) in the agglomeration scaling behavior curve.

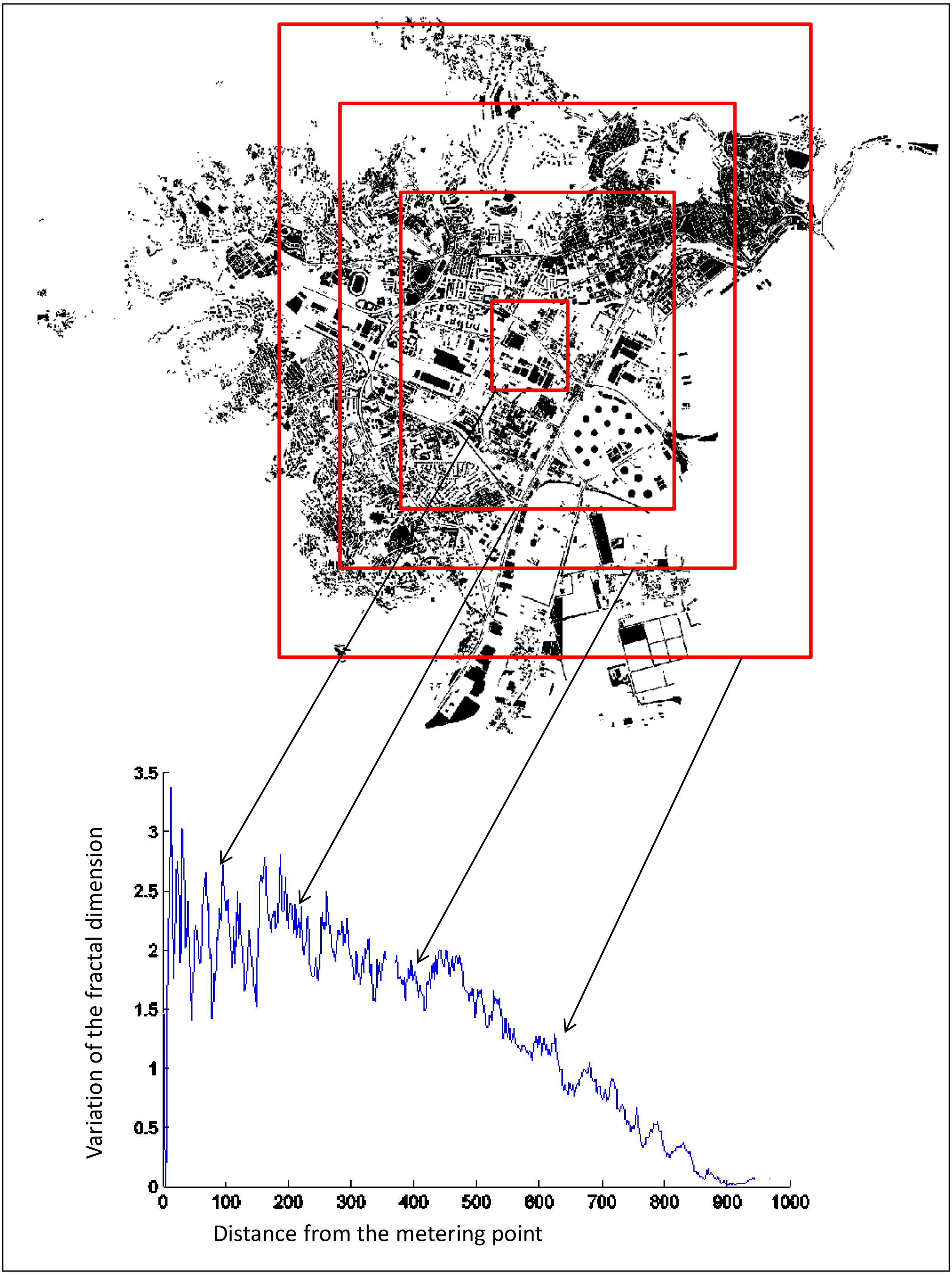

Fig.4. Bejaia city map and scaling behavior curve source: authors 2019

The rhythm of the city's components makes it a dilute, fractured space that often undergoes a series of deformations between stretching and digitation. Such ruptures lead to boundary breaking, followed by dilution of the urban space agglomeration. Therefore, the decrease reflects the loss of tissue homogeneity, and is irregular or complex as one progresses to peri-urban areas.

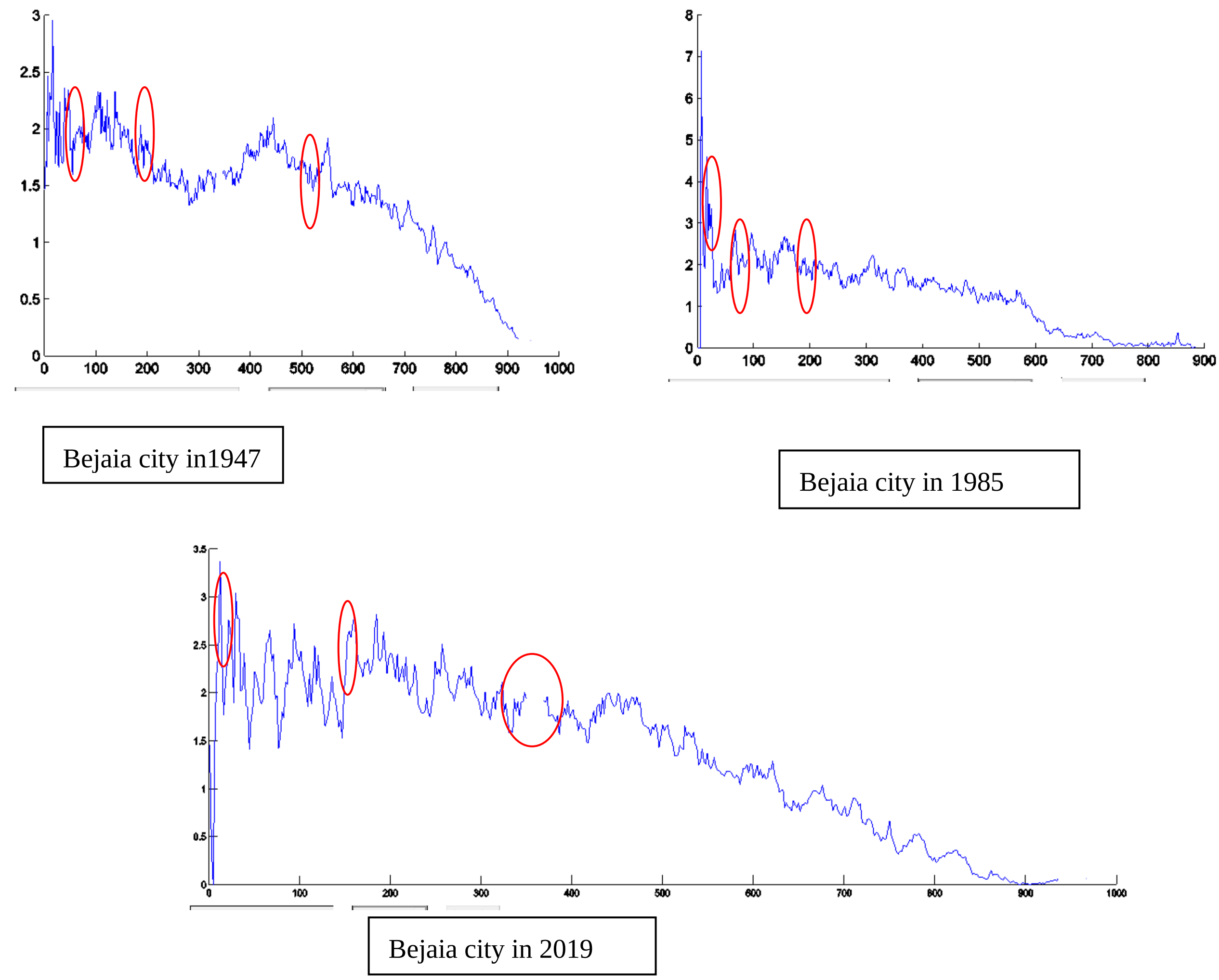

Fig.5: curves scaling behavior, Source: authors

Presence of disturbances (gaps) in the curve of the scaling behavior of the agglomeration: Reading the scaling behavior curve shown in the figure leads to the following observations being made. The presence of inflections or visible variations in the curve. These disturbances occur throughout the urban fabric of Bejaia, meaning there are major breaks (gaps) and successive physical obstacles. Such ruptures are sufficient for the big physical sanctions that make up this agglomeration. These gaps consist of topographic breaks (ridges, mountains, and wadis), as well as physical cuts such as northeastern forests, and road cuts through the urban system by segmenting the different communities. These results show a decrease in the curve of scaling behaviour. Which means a gradual loss of morphological homogeneity at the stage of mass distribution of urban tissue. In comparison, and hence the advantage, irregularity or confusion as we push towards the peripheral areas. There are shortcomings in the 2019 tissue along the curve formed by discontinuous urban tissue, varying geometric masses and forms, and population density on an urban block scale. Many peri-urban units are also small, while others are much bigger. Likewise, the shapes are very contrasting, from the sowing of dispersed particles to the streamlined collection of various contours elongated along the axes of the urbanization. This suggests that this area is experiencing a significant break in the spatial structure of the built fabric. And drawing the segmentation lines between different behavioral areas would seem appropriate (Frankhauser, 1997).

3.3.3 The dilation analysis

a. The degree of compactness of the tissues:

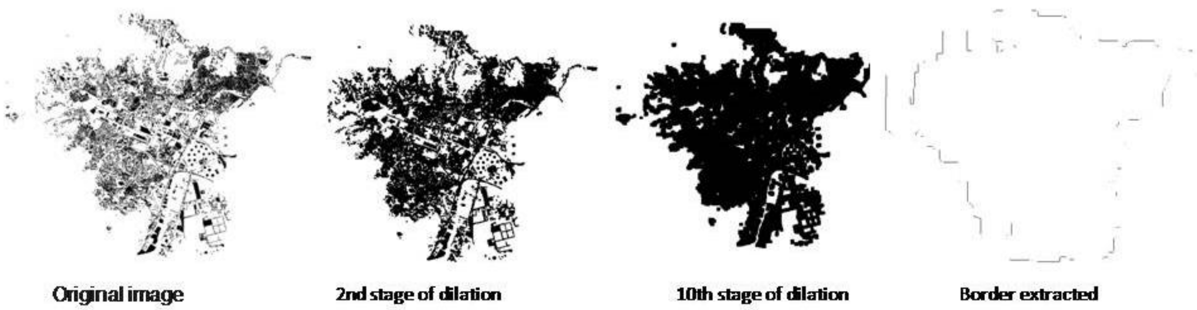

Fig.6. Some steps of expansion for Bejaia border extraction 2019
Source: authors 2019

This structuring isn't surprising; this represents the gradual separation of roads in urban history. Traffic spaces are both smaller and more interstitial. The loosest fabrics are those from 1985 and 2019, characterized by the presence of industrial and commercial fabrics or mixed fabrics; whose simple mesh is very distended because of their required adaptation to modern means of transport and movement (wide roads with multiple lanes). We see a logic that separates the continuous dense structure from the less dense continuous structure and discontinuous structures of various kinds. Categorized by the extent of spaces left free between buildings, the aggregate threshold is quickly reached.

The morphological unit with the current achieved aggregation threshold is the rear port and the operational area that well reflects the over-size designed for deposit areas and industrial and traffic routes. The high degree of compactness of the city in 1947 as opposed to that of the city in 1985 or 2019 is expressed mainly in the radical separation of roads in urban history. Circulation spaces in the old town of 1947 are smaller, so are interstitial spaces and the resulting typology of fabrics translated here. A difference in the treatment of unbuilt spaces: where the dense and old fabrics of the city center are in contrast with the more ventilated fabrics of the more recent 2019 areas.

b. The degree of dendricity of tissues

For each fabric, a correlation study systematically calculated the dimensions of the fractal surface (D_{surf}) and the boundary (D_{bord}). Besides the fractal dimension D, which is also called the type factor, we also held the indicator an. The Gaussian dimension and dendricity index determine whether the perimeter or boundary morphology is sinuous, or "simple geometric shape" more smooth.

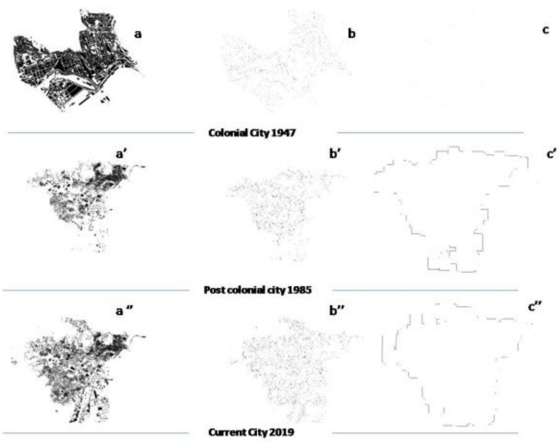

Fig.7. steps to extract the borders, Source: authors 2019

a, a ', a': original form of city b, b ', b' ': extraction of the border of the surface of the city _ c, c', c '': extraction of the border of the perimeter

The urban tissue roughness index in the city ranges over time between 0.40 and 0.74.Finally, the synthetic index (Is) of complexity or roughness (Badariotti, 2005) takes the value of 0.403, very similar to the minimum value, suggesting the low morphological roughness, so (Dbor / agr) approaches the value 1.5. So, we have a heterogeneous perimeter and a homogeneous surface (Dsurf) is moving closer to the value 2.

Indicating morphological roughness, the synthetic index (Is) of complexity or roughness (Badariotti, 2005) takes the value 0.60, very close to the maximum value 1. Thus (Dbor / agr and Dsurf) are identical to the values of 1.5 and 2; thus we have a heterogeneous perimeter and a homogeneous surface with a smooth limit. The Dtot is high in 2019, the existence of gap with Dbor elevated. We get a structure with a hierarchical base, roughness and dendric boundaries.

Table 2. summary of the results obtained, Source: authors

Index	Dsurf Ou Dcorr	a	Dbor/tot	Dbor/agr	φ	δ	Is
	Degree of homogeneity	Complexity	homogeneity of the border	homogeneity of the border	fragmentation	Dendricity	roughness
colonial city 1974	1.753	1.802	1.741	1.156	0.506	0.784	0.403
post colonial city 1985	1.582	2.216	1.747	1.329	0.314	0.810	0.747
Current city 2019	1.711	1.277	1.809	1.317	0.373	0.871	0.606

We see the index of fragmentation φ equals 0.5 to 0.3, a value similar to the max value 1. This means that $D_{bor / agr}$ is very far from $D_{bor / tot}$, which indicates that agglomeration is not the main aggregate. The dendricity index δ= 0.8 is close to the maximum value 1; this is a fabric whose spatial structure is identical to that of a Sierpinski carpet.

D_{surf} essential, highlights the mark of a high contrast-built fabric that is far from the typical space coverage. The low fragmentation index value φ = 0.3 suggests that the agglomeration is dominated by the central aggregate. The past of Bejaia's urbanization helps to understand these morphological characteristics: the urbanization has spread along the axes of the railway and the growth strategy is attempting to use natural resources such as the submam wadi, the lake and Gouraya National Park.

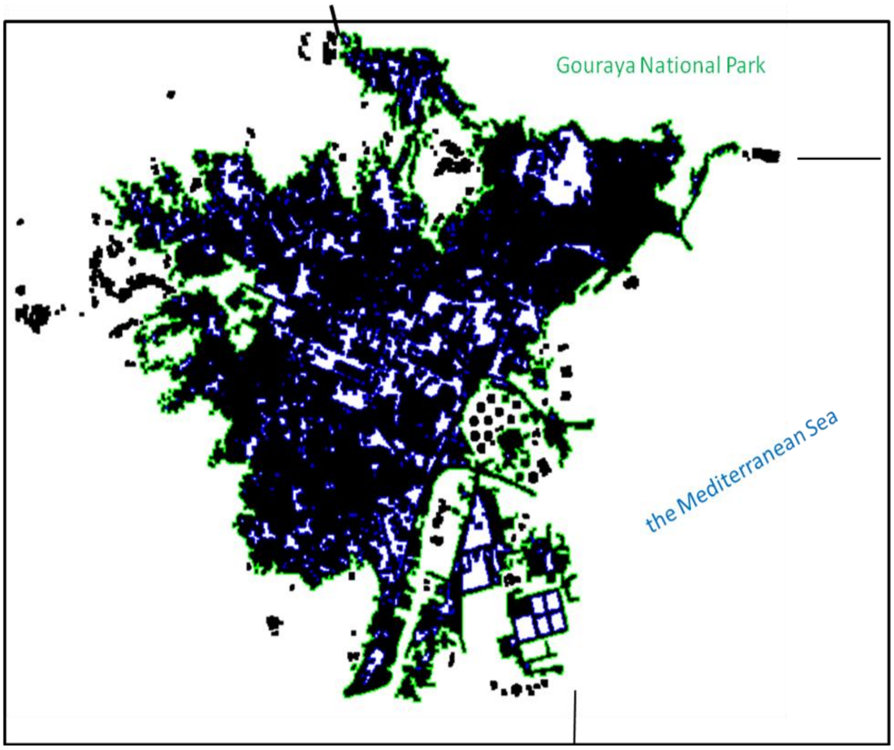

Fig.8. Maps showing the spatial dilution of the bejaia city, and gap observations

Sources: authors 2019

Bejaia, where urban sprawl is not subject to stringent constraints, the condition observed is unpredictable (the edge dimensions of the aggregates are between 1.15 and 1.32). The post-colonial city in 1947; where local politics tried to control neighborhood-level urban sprawl, the fractal dimension of the edge of the central aggregate is indeed 1.15. Mount Gouraya also prevented the encroachment of urbanisation, the edge of the ridge follows

At the other hand, the dimension reaches 1.32 in the pre-colonial and current city where urbanisation has been more gradual and less regulated; In the case of bejaia in 2019, we found that the edge is very tortuous, the dendricity index reaches a value of $\delta = 0.87$, but the fragmentation index value is significantly lower: $\varphi = 0.3$. The same trend for the city of Bejaia in 1985 can be observed; in both cases these are medium-sized cities, more marked by industrialisation.

4. DISCUSSION

The above results verify Conceptual considerations allow the achievement of objectives of urban planning aimed at reducing space use while ensuring a good quality of life and sustainability. Reference models may be conceived as illustrative elements of the key properties of various types of urban structures beyond the morphological study. (Frankhaber, 2005)

Fractal analysis provides a time-scale approach which defines variable urban boundaries for a town. A collection of urban boundary lines and interstitial spaces may be used to explore the connection between the intra-urban and the urban. Thus, the relation between the sense of urbanization and urban morphology can be studied. It also helps us to make predictions about the development of urban fabrics characterized by more commercial or administrative industrialisation or fabrics.

The factors that can affect a city's spatial structure can be calculated through fractal analysis; namely national laws and local policy orientations, natural and artificial barriers (ph. Pannerrai, 1999) and their topographical location.

Fractal analysis allows for further study of the form of the "oil spots," thus its bottom, whose purpose is to quantify and describe the city's dilution in space. The findings of morphological analyzes have shown that fractal indicators can pertinently describe the distribution of the built-up area in urban fabrics. Through observing the fractal behavior of an urban structure at different times, the incremental emergence of various forms of spatial organization and interlocking of scales can be observed.

We used radial analysis, and compared these analyzes 'scalant behavior curves. We can see that, during urbanization, the variations around the dominant behaviour, Figure 4, always fall. That means the spatial structure of these urban fabrics is gradually following the scale nesting concept, which is characteristic of fractals. (Frankhaber, 2005)

Nevertheless, if we take the fractal dimension values into account, we can see that they always increase over time, i.e. they tend towards two. Therefore, the built-up surface is progressively covering the room. This can be demonstrated by the advent of roads and transport routes and their layout. Analyzes have also shown, however, that other development policies create fabrics in which communities are concentrated along transport routes (zhun), served by public transport, and thus the fractal aspect of which is less.

Let us now seek to draw some conclusions about urban planning from those observations. Given though the study of the built-up area and urban boundaries alone does not provide details on the land use of interstitial spaces, it is clear that a uniform spatial arrangement cannot accommodate a large variety of amenities. (P. Frankhauser, 2005) In addition, there is also a shortage of neighborhood-level community resources. People are forced to drive in order to reach the various types of services and it is obvious that these communities are traffic generators.

The change in the fractal dimension over time causes the cities 'fractality to fall apart by itself. We may also deduce from the intra muros that the pre-colonial city passes through. This time the towns needed a wall to protect the space given to the township. Characterized by its growth, new problems appeared (from bejaia adaptation to relief, ilotage); these were solved by urban planning, but there was already a multi-scalar system (islets plot and squares).

The drastic urban planning phenomenon will be a dilution of space. Such a system will provide convenient access to unbuilt and virgin land in peri-urban areas for a large number of people. At the other hand, the lack of centrality will be absolute. All "urban" services will be distributed in different parts of the city. Such a spatial configuration will also allow people to drive in order to access the different services provided at the various locations. And very large traffic flows creating. As a result, the natural areas decrease; rural and urban converge due to habitat dispersion. Thus, the spaces perceived as holes within the city could be an alternative to the rebuilding of the city on the city. By combining appropriate urban planning and urban design, the fragmented and distant parts of the city could be stitched together.

City fractal structuring remains the prerogative of a socio-spatial mechanism that is dependent on each city, but for any urban agglomeration this structuring can be observed simply because of the geographical awareness of urban space.

5. CONCLUSION

Regional dilution and urban form development contribute to the variance of the "town boundaries" limits on various time scales. From this study, which dealt with the global level of fractal analysis, we can conclude that the spatial structure of the Bejaia agglomeration follows an internal law of regulation. Therefore, it presents a simple fractality of its urban structure.as shown by the modification of the two curves, empirical and estimation; result of the overall correlation analysis. Originally characteristic of Bejaia's urban location, the morphological compactness is disrupted by the presence of topographical, geomorphological (wadis) and natural (Gouraya) and physical (traffic and rail) barriers. Such perturbations were proved by the existence of inflections and deviations observed on the scaling activity curve resulting from the radial analysis. The spatial extension of the urban infrastructure is thus supported by a decrease in fractal dimensional values from the historical core to the periphere. Beyond the city center and beyond the natural borders to rural and isolated areas, and on the axes of urbanisation.

Studying the grid of the city of Bejaia's urban structure has led us to authenticate a set of urban forms; a morphological complexity due to the proliferation of urbanization processes over its history. In terms of internal spatial organization, the urban fabrics analyzed in this agglomeration vary morphologically from one another; surface distribution and hierarchization of solids and voids, and therefore differences in homogeneities and internal spatial ordering rates. It should be noted that the fractal analysis enables the representation of urban morphology, and the spatial organization of urban aggregates. This must, however, be accompanied by an examination of the facts, using methods already developed.

However, our findings are still preliminary, as they were derived from data analysis for a single agglomeration. Nevertheless, its precision can be checked by comparing the statistics collected with the other agglomerations. Hence, most of the findings are significant, but need to be investigated further. In addition to a multiplication of steps that could help stabilize these findings, knowledge of morphological indicators should also be further established, allowing for a better relationship between the static approach of fractal measurements and the city's dynamics.

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