

ORGANIC VS PLANNED: THE EVOLUTION OF THE SPATIAL CONFIGURATION OF TETOVO

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Abstract

The paper explores the processes that shape the urban configuration of cities, with a particular focus on Tetovo. Both, the organic - bottom-up and planned - top-down processes, shaped the spatial configuration of Tetovo throughout the centuries. Tetovo evolved organically from the 14th century until World War 2 (WW2) through a self-organizing process. After WW2, as part of Yugoslavia, Tetovo was supposed to transform into a modern city. Its existing urban fabric was disregarded in the new planned - top-down strategies. However, most of these new ideas were partially implemented and Tetovo continued to grow by both processes. A similar top down approach, with minor methodological modifications, was adopted in planning policies in North Macedonia after its independence at the end of the 20th century. Yet again, planning could not guide nor even follow the rapid development of Tetovo. The asynchrony between planning and factual growth had negative repercussions on urban form resulting in chaotic manifestations of the built environment. Hence this paper aims to understand and explain Tetovo's spatial configuration beyond its simplistic geometric descriptions at different stages of development, objectively, and analytically. The study relies on space syntax as the core theory and methodology as through an analytical set of tools it offers objective spatial configuration analysis. It reveals the hidden regularities of the organic spatial configuration and Tetovo's natural development disruption caused by the top-down modernistic planning approach. It also suggests that planning strategies have to consider the existing socio-spatial context to avoid negative manifestations of the built environment in the future development of the city. However, further research that would also include other cities of North Macedonia is necessary to fully decode spatial and behavioral patterns and incorporate them into urban planning policies.

Keywords: Organic, Planned, Spatial Configuration, Tetovo, Space Syntax

1. Introduction

The most notable classification of cities is the one based on their emergence and evolution. They are classified into organic and planned. The planned "...city is laid out by an emperor, bishop, or other authority possessed of the power to start a settlement from scratch...The organic city includes those settlements established at a geographical point but left to evolve in physical pattern as functions and fates determine (Vance, 1977, 24)." Most of the cities are, however, more or less, evolved by both organic growth and planned interventions. The same applies to Tetovo as well.

Both, the organic bottom-up and the planned top-down processes shaped the spatial configuration of Tetovo throughout the centuries. From the 14th century until World War 2 (WW2) Tetovo as part of the Ottoman Empire evolved organically by a self-organizing or bottom-up process. After WW2, when Tetovo became part of Yugoslavia, a new top-down planning approach was introduced. Regular street network, mono-functional zoning, and megalomaniac interventions as a reflection of the new modern planning and ideology were supposed to change the physical appearance of Tetovo, with no regard to the existing urban fabric. Most of these new ideas have never been implemented and Tetovo continued to grow by a parallel top-down planned and organic bottom-up process. A similar, top-down approach with minor methodological modifications was adopted in planning policies in North Macedonia after its independence from the Socialist Federal Republic of Yugoslavia (SFRY) at the end of the 20th century. Once again, planning could not guide or even follow the rapid development of the city. The asynchrony between planning and

factual growth had negative repercussions on urban form and resulted in confusing manifestations of the built environment.

Tetovo's spatial configuration certainly holds traces of the transformations during its evolution. But what are the morpho-syntactic properties of the spatial configuration of Tetovo? How exactly each process, the organic bottom-up, and the planned one, shaped the urban form of Tetovo? What spatial outcomes produced each process? How does the spatial configuration of Tetovo relate to other examples of cities across different cultures? This paper, which is an excerpt from a master thesis on Urban Nodes (Ferati, 2011) is supposed to answer these questions through the diachronic and synchronic analysis of the evolution of Tetovo's spatial configuration. The paper aims to explain the configurational properties of the spatial structure of Tetovo through different stages of development, objectively and analytically, beyond simplified descriptions of its structure. It also aims at explaining the complex order of the organic structure and the effects that planning had on spatial and behavioral patterns in Tetovo. The research should provide a better understanding and insight into the hidden regularities of Tetovo's spatial configuration, to help plan the city's future development.

A theoretical framework in the first part of the paper is opening a general discussion on organic and planned cities. It is focused on the spatial features associated with each process of city formation. The second part of the paper briefly introduces the socio-political conditions under which settlements in North Macedonia in general and Tetovo developed during the centuries. It describes the processes that shaped Tetovo since settlements emergence up to its current state of development. The transformation of the spatial configuration of Tetovo is studied through a configurational approach which is based on space syntax theory and methodology. Therefore, the third part explains its methods for collecting, processing and generating data. Whereas, the fourth part aims to show the process and the level of transformations of Tetovo from organic to relatively geometric city, by comparing and discussing the results from the analysis. In each of the development phases, the spatial configuration is explored through geometric properties; syntactic properties; through the relationship between the parts and the whole (of the spatial configuration); and through the land use activities generated in the spatial configuration.

2. Theoretical Framework

In general, as already mentioned, cities have been shaped either by a self-organizing bottom-up or by a top-down planned process. "From ancient times, towns and cities have been classified into those which grow "naturally" or "organically" and those which are "artificial" or "planned" (Batty and Longley, 1994, 7). They differ in several key aspects. The former is shaped by many individual local decisions on a small scale over a long period, while the latter is shaped solely on one or few imposed ideas on a larger scale over a short period. The organic city is more irregular and adapts to both the local spatial and socio-cultural context, while the planned city is more geometrical and usually disregards the context (spatial or socio-cultural) as it was the case with the modernist model. However, most of the cities are shaped by both processes. "... it is impossible to identify solely organic or planned towns, for these two classes of development merge into one another in many different parts of the city and at many different scales" (Batty and Longley, 1994, 8).

Broadly speaking, the most notable and primary feature of organic cities is the irregular spatial configuration network. Its irregularity is often misinterpreted as the cause or outcome of uncontrolled, uncoordinated, and chaotic spatial organization. The organic street network as a concept for organizing urban space, and with it the fundamental relationships between open space and physical structures, was rejected by the advocates of modernism (Le Corbusier, 1987). Instead of the organic, a new revolutionary model for the city was proposed at the beginning of the 20th century. Nevertheless, cities have been planned even before antiquity. But, apart from the geometric structure, the Modernist city has little in common with the "traditional" planned city. Beside the division of the city into functional zones and the introduction of fast motorways to overcome distances, both between settlements and between the various functional zones within the city, the most notable difference is the attitude towards the relationship between the route and

the building. The Modernist city “altered the relationship between the route and the building” (Marshall, S. 2005, 3) and “it proposed an inverse relationship between movement and place” (Marshall, S. 2005, 4). In the traditional city, the route and the building were locked together. Whereas “Modernism set up a new urban model that liberated the forms of roads and buildings from each other... The Modernist model allowed roads to follow their own fluid linear geometry, while buildings could be expressed as sculpted three-dimensional forms set in flowing space” (Marshall, S. 2005, 6). It should be noted, however, that the reasons for the emergence of a new model for the city were complex, ranging from improving living conditions that decreased due to the negative impact of the industry to motor vehicle accommodation. Whatever the reasons, this new ideology although relatively late (after WW2), reached and had strong impact on the cities of North Macedonia as well. The main general principles for the design of the new modern city were:

- Geometric and hierarchical street network;
- Decentralization (and dislocation of the center);
- Mono-functional zoning;
- New industrial zones;
- New residential typology.

Cities planned based on these functionalist principles were losing their human scale. They became car – dependent, fragmented, segregated, anti-social, sterile, and monotonous (Commission of the European Communities, 1990). These planning policies’ negative consequences on the city were mainly noted in the 1960s by Jane Jacobs (2000) and Christopher Alexander (1966). To overcome the dysfunctionalities of the modern city, they began to focus on the traditional organic cities for answers. It slowly became evident that organic cities are by no means chaotic, uncoordinated, or uncontrollable. These cities grow spontaneously and “naturally,” and are generated through a series of individual decisions and considerations that act more randomly over a long period (Batty & Longley, 1994, 8). The complex order of organic cities was best explained by Bill Hillier and colleagues through configurational approach better known as space syntax. They were able to reveal, objectively and analytically, the hidden regularities of these cities (and cities in general). According to the theories on centrality as a process, natural movement, and movement economy, there is a high correlation between the spatial structure and behavioral patterns (Hillier, Penn, Hanson, Grajewski & Xu, 1993; Hillier & Penn, 1996; Hillier, 1999). “The spatial structure of the grid is the key element. Organic towns which have grown over a long period seem to optimize certain key aspects of movement and land-use patterns by exploiting the structural properties of the urban grid” (Hillier and Penn, 1992).

Through Doxiadis's organic planning approach and his ideas of centrality (Figure 1), Batty and Longley (1994, 34) illustrate the genesis and development of the organic city. “The basic organic model involves the growth of a town from some center of initial growth or seed, the growth proceeding in compact form around the center in waves of development like the rings of a tree. This growth, however, is likely to be distorted by radial lines of transportation along which growth often proceeds faster due to increased access to the center, the ultimate form of town thus resembling some star-like shape” (Batty & Longley, 1994, 33). In a similar fashion Kojic (1976) describes Balkan organic cities (Figure 2). Initially, trading centers arose at the intersection of main roads. They later became Bazaars, i.e. working zones with predominantly trade and craft functions. This is the foreground network that appears as invariant across cities from different cultural regions and it is shaped by micro-economic processes (Hillier, 2001). Around the centers and between the main radials that lead to the center emerged residential units, mostly divided by ethnic or religious affiliation. These residential units on the background of the network of public spaces are shaped by sociocultural factors and they generate the differences between settlements (Hillier, 2001).

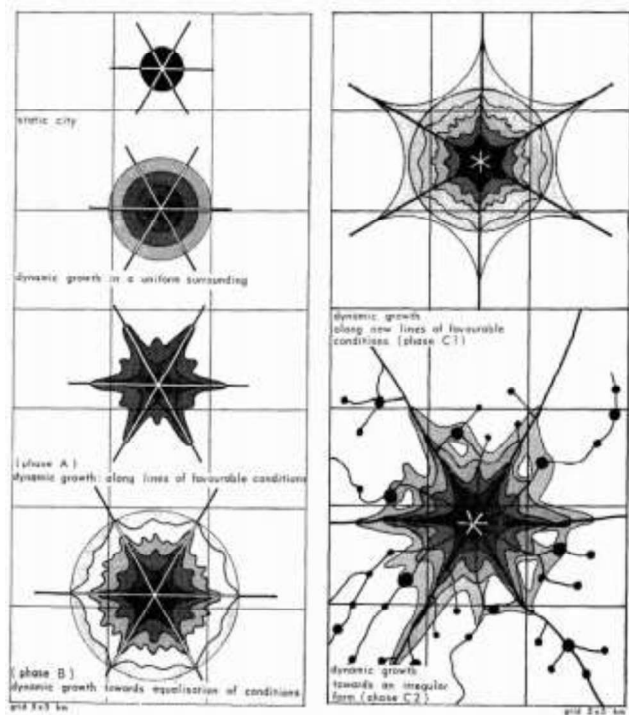


Figure 1. The shape of the organically grown (from Doxiadis, 1968). Reprinted from *Fractal City* (34), by Batty, M. & Longley, P., 1994, London: Academic Press.

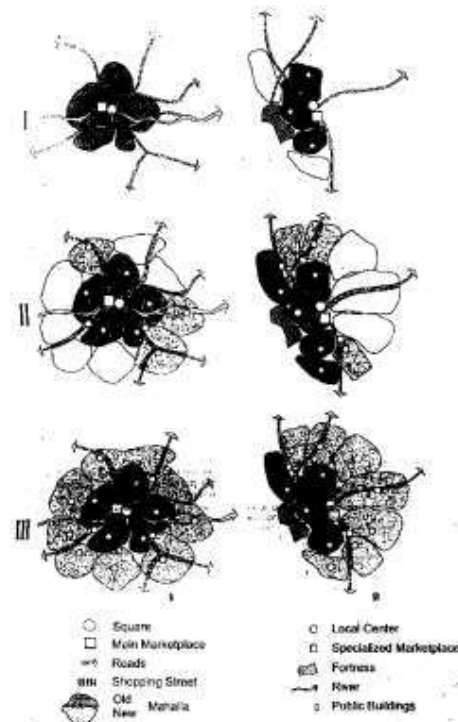


Figure 2. Development stages of old Balkan Cities. Reprinted from *Stari balkanski gradovi, varoši i varošice* (17), by Kojic, B., 1976, Beograd: Institut za arhitekturu i urbanizam Srbije.

Generally, organic cities, including the ones in North Macedonia, are usually described by the following properties:

- Irregular street network;
- Compact spatial configuration;
- Mixed use activities;
- Hierarchical network of centers and sub-centers.

However, as mentioned above, space syntax provides additional understanding of cities that goes beyond their geometry, since it deals with relations, configurations and uses as well (Karimi, 2002). Therefore, Hillier (2001) used this approach (coined by him and his colleagues) in a comparative framework to study the geometric properties, the configurational properties, and the relations between parts and wholes of various cities from different cultural regions (Arab, European and American). The findings derived from the study are presented and used in the following parts of the paper for comparative analysis.

3. Brief History of Tetovo

Since ancient times, the North Macedonia region has occupied a strategic geographical position in the Balkan Peninsula. Two of the most important roads linking the West and East, Via Egnatia and Via Militaris, crossed its territory or passed in its close vicinity. On the other side, the Vardar valley served as a link between Northern Europe, the Middle East, and the Suez Canal (Trajanovski, 2005, 13). The strategic location has always played a significant role in the emergence of major cities. "On Vardar it was Scupi and Stobi and on Via Egnatia it was Lychnidos, Heraclea ..." (Cipan, 1978, 11). Archeological excavations indicate the existence of other ancient settlements, including one nearby Tetovo. However, the data available on ancient cities are scarce, and assembling them into a generalized image is difficult. Of all the ancient cities in North Macedonia, only Lychnidos (Ohrid) survived at the same location. Scupi and Heraclea were displaced and grew in Skopje, respectively Bitola, while Stobi completely vanished.

Medieval settlements emerged at the same site or nearby ancient cities of North Macedonia during the Byzantine Empire. The data on them are also scarce. At that period, the term city meant a fortification or fortress. It served to protect the ruler, the administrative center, the main roads, and the suburbs (Deroko, 1951, 17). Many medieval fortifications have either been demolished or have simply disappeared. However, settlements arose around the fortresses, or in their immediate vicinity. Later they became cities under the Ottoman reign. In the case of Tetovo, the medieval settlement emerged close to Pena River on the foothills of Sharr Mountain. Its location at the intersection of two main roads (former Prizren - Tetovo - Skopje, and Skopje - Tetovo - Gostivar) had a major role in its development as an important administrative and commercial center. As such, it has also triggered demographic growth by attracting people from neighboring settlements.

Later, under the Ottoman Empire, North Macedonia's cities underwent substantial changes. The sequential fluctuations of the Ottoman Empire's long reign affected not only the configuration of the city but also the social and cultural characteristics of the population. In the period between the 14th and 16th centuries, when the Ottoman Empire was still powerful and intact, the urban population was gradually Islamized. Consequently, organic cities with predominantly Islamic characteristics were gradually emerging and developing. In subsequent decades, the Ottoman Empire experienced substantial internal and external turmoil, and its power slowly deteriorated. Thus, the development of the cities stagnated. Nevertheless, at the beginning of the 19th century, as the empire stabilized, and the socio-economic conditions of the native population improved, the cities reached their highest level of development (Cipan, 1978, 26).

The developments in the Ottoman Empire had a major influence on the organic spatial structure of Tetovo too. They, along with local circumstances, caused its constant demographic and territorial changes. In 1463 Mehmed Beg noted that Tetovo, with many shops and workshops, is one of the most advanced cities in the Polog region. Whereas Celebia's travelogue noted its rapid growth in 1470, an increase in population that triggered the expansion of the eastern and southeastern boundaries of the city (Dobrovic, 1950, 62). Yet, in the 17th century, Tetovo experienced a great fire. It caused the decline of Tetovo's importance for the whole century (Nikolovski, 1971, 155). In the 1840s Amy Bue noted a population of 4,000 or 5,000. Later, at the end of the 19th century, the population grew considerably, reaching 19200 inhabitants ("Тетово и тетовско низ историјата," 1982). That is the period in which the Ottoman Empire is stabilized, and socio-political conditions improved. Due to World War 1, socio-political and economic conditions stagnated again in the early 20th century (Svetozarevic, 1999). Therefore, by the third decade of the 20th century, when Tetovo became the administrative center of the northwest part of North Macedonia, the population decreased to 15119.

However, little is known about how the socio-political and economic developments influenced the evolution of Tetovo's spatial configuration. Tetovo, probably as the other organic cities in North Macedonia during the Ottoman reign, emerged from similar morphogenetic principles described in the previous part of the paper. It also evolved from an initial trading center at the intersection of the main arteries. The trading center later evolved into Bazaar, whereas space in-between the main arteries is developed with residential units. As Tetovo grew into a fully developed city, new Bazaars emerged following the same principle, at the intersection of main routes that lead to neighboring settlements. In addition to occupying strategic locations within the spatial configuration of the city, the Bazaars, open markets, and neighborhood centers have also played an important role in the development of public life. The potential of these strategic locations was noted and used by religious authorities to increase their influence on society. Hence, they marked their presence by inserting a mosque in Muslim - dominated neighborhoods, or a church in Christian-dominated ones (Ferati, 2012). The residential units were divided by religious affiliation into Muslim and Christian. Houses of the Christian and poorer Muslim community were located in the foothills (Dobrovic, 1950, 62). In small irregular plots along the perimeter of the street, they were densely arranged in rows, often lacking gardens, and oriented mainly towards the streets. While the houses of the ruling Muslim elite were freely distributed in the flat areas of Tetovo, they were closed to the street and oriented towards the spacious gardens. In both cases, houses were mostly one or two floors

and organized into smaller housing units – *mahallas* (Aleksievska and Voljinec, 2000). The development stages of Tetovo are illustrated in Figure 3. The illustration of its evolution before the WW2 is based on the existence of neighborhoods (*mahallas*) at certain periods during the Ottoman rule. However, due to scarce data, a comprehensive picture of Tetovo's growth over the centuries needs further research. Nevertheless, seen in general, Tetovo continued its organic development regardless of the socio-political and economic divergences. Its development displayed many of the characteristics of the organic city, such as the irregular street network (Figure 4), the hierarchical network of centers, and the mixed – use activities.

The features of the organic city are being revealed as new concepts and new theories in the contemporary urban theory, known as "Compact City", "New Urbanism", "Mixed Use" and "Smart Growth," while in fact, they have always been present in the cities of North Macedonia until the emergence of the industrial revolution. In Western Europe, the industrial revolution began in the 19th century. The new technology revolutionized the social and economic circumstances. To accommodate the "modern" life new urban planning strategies based on geometric and hierarchical street networks, mono-functional zoning and decentralization, was proposed for city development.

Yet, the modern ideology echoed much later in North Macedonia. The modern urban planning paradigm was adopted by the new socialist ideology right after WW2 in order to transform the organically developed cities as a social necessity for strategic use into cities that reflect the symbolic ideology of the new ruling system. With the victory of the People's Revolution, Macedonia gains an important place in the Federal People's Republic of Yugoslavia (FPRY). Urban planning as a discipline, along with the country's 1947 Five Year Plan for industrialization and electrification, had a significant role in the growth of the FPRY economy. This plan envisaged the reorganization of the twenty most important cities in the spirit of the "modern" urbanism (Dobrovic, 1950, 62).

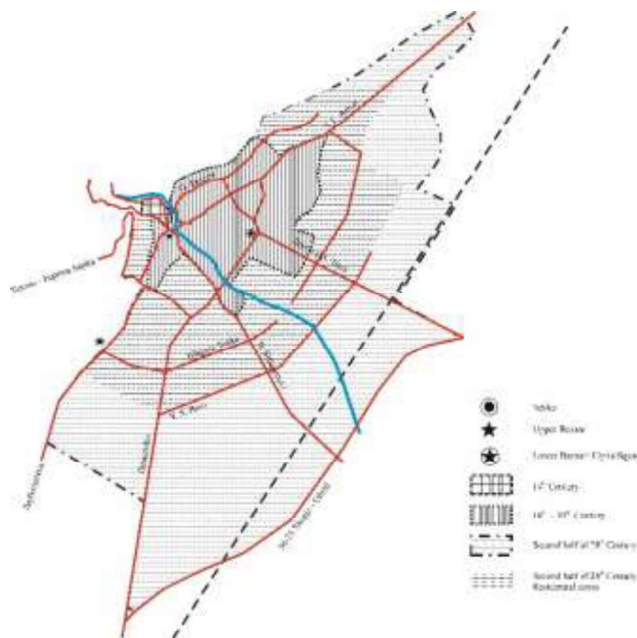


Figure 3. Tetovo's stages of development



Figure 4. Organic spatial configuration of Tetovo

The proposed developments according to the new plans were entirely alien, and had little in common with the existing spatial configurations of the cities of North Macedonia. They demanded complete urban transformation with particular focus on the accommodation of motor vehicles and their fast and efficient flow. "The circulation of traffic demands the straight line; it is the proper thing for the heart of a city. The curve is ruinous, difficult and dangerous; it is a paralyzing thing." (Le Corbusier, 1987, 10). The curvilinear street network is seen as a major obstacle to the development of the city, so new energetic Haussmanic

interventions were proposed for the realization of new modern ideas (Pota, 1950). These planned transformations required large scale interventions. They usually began by spatial and functional decomposition of the center hence the organic network of streets and public spaces undergoes significant changes. Superimposition of gridiron street network with straight roads that break through the center and the neighborhoods, zoning, and major building structures destroyed the organic street network. Under these circumstances, the physical appearance of some of the cities in former Yugoslavia changes significantly while in others less. The mid-1960s modern city development strategies influenced the organic structure of Tetovo too. New interventions, mainly residential zones dominated by collective housing are planned in the spirit of modernism. They were partially implemented, nevertheless, the center of Tetovo, including the bazaar, was demolished, and transformed (Figure 5). But the city also shows resistance to new ideas and planned transformations, many parts of the organic urban fabric remain relatively unchanged to date (Figure 6 and Figure 7). During this period Tetovo has a steady level of growth. In 1971 the population number reached 35792. Besides, the spatial changes caused by the new planning strategies, a new phase in the relationship between religious and ethnic communities were also introduced. Tetovo's dual character because of the spatial division of the Muslim and Christian populations in the past is gradually disappearing.



Figure 5. The beginning of the interventions in the center of Tetovo, retrieved from <https://mapio.net/pic/p-18205912/>



Figure 6. Planned spatial structure of Tetovo after the war



Figure 7. Fragment of the existing spatial structure of Tetovo



Figure 8. Current spatial configuration of Tetovo



Figure 9. Informal residential zone in Tetovo, retrieved from <http://www.google.com/earth/index.html>

The implementation pace of such a city-wide scale transformation was slow and the very process was interrupted to some extent after the independence of the Republic of Macedonia at the end of the 20th century. The newly created democratic social order was also accompanied by new urban planning policies. They nonetheless adopted the post-war modernist approach, despite some minor methodological changes and greater respect for the existing urban fabric. As far as Tetovo is concerned, new planning policies in the 1990s, and even the current ones, partially incorporate both the pre-war and post-war existing spatial structures, as well as the primary street network from the 1960s and 1970s planned spatial configuration. These new plans were supposed to establish the basis on which the city should develop, nonetheless, to some degree Tetovo grew independently and little influenced by them. The new plans always seem to be a step back and more of a follow-up tool than a development tool. Inflexibility and poor synchronization of plans with factual situations and citizens' needs lead to a considerable number of informal buildings. Lack of legal provisions and adequate treatment for such informal constructions complicates the urban environment design process. However, these buildings are part of and are shaping the urban fabric of Tetovo along with the rest of the elements of the city's urban form. Based on the statistical data from the Municipality of Tetovo, on 26.07.2019, around 13000 applications arrived in their offices to legalize the illegally constructed buildings built before 2011. Figure 9 contains fragments of informal neighborhoods that emerged in the Industrial Zone at the beginning of the 21st century. Obviously, they reflect the self-organizing bottom-up process of spatial organization that unfolds parallel to the top-down planned process lead by authorities. So, cities in North Macedonia in general, and Tetovo have a hybrid spatial configuration with characteristics of both the organic and planned concepts of spatial organization. It tends to develop into a model with a relatively geometrical shape, given that the post-war public space network is the most common element that is transferred from plan to subsequent plan.

4. Methodology

Space syntax theory, methodology, and techniques offer an objective and analytical procedure to describe, compare and interpret human settlements, therefore they are borrowed and used to explore the evolution of the spatial structure and the configurational properties of Tetovo since pre-WW2. "... Space syntax analysis provides a simple, realistic, and workable spatial model of the city; it takes all elements of the city into account and analyses them as interacting parts of a system; it gives quantitative values to elements and provides the possibility of statistical and graphical comparisons within urban systems; and finally, it gives the means to analyze and compare systems of different shapes and sizes" (Karimi, 2002, 3). To process the analysis, the spatial structure of the settlement is decomposed into axial lines and represented as an *axial map*. An axial line is the longest line of visual reach (Hillier and Hanson, 1984) and physical reach. Whereas "an axial map of the open space structure of the settlement will be the last set of axial lines which pass through each convex space and makes all axial links" (Hillier and Hanson, 1984, 91-92). Further on, the axial map is represented as a mathematical graph model. The graph is an abstract representation of a set of elements and their relations, in which each element – axial line is represented as a vertex, and each relationship between elements as an edge, thus allowing mathematical analysis of the configurational properties of each spatial entity as well as the whole system. Besides the axial map, the spatial configuration is also analyzed via a segment map. The segment map is a derivative and a finer representation of the axial map, in which the axial lines are divided at their intersection into segments.

To perform the analysis, the research is relying on *Depthmap* - a computer software developed at the University College of London. *Integration* and *Choice* are key accessibility measures in the analysis. *Integration* is a measure of the relative accessibility of space (axial line or segment) in a spatial system and indicates how close one space is to all other spaces in the system (Hillier and Hanson, 1984, p. 108), whereas *Choice* indicates the relative location of space between all pairs of spaces in the spatial system (Wai, 2005). The level of accessibility on the processed maps is indicated by the color of each line or segment, with red being the most accessible, and blue the most segregated. Both measures can be calculated at different radii, ranging from local - by considering a local network of public spaces, to global-regarding the whole network.

The evolution of the spatial configuration of Tetovo since pre-WW2 is explored through the geometric properties – line length and angle of incidence that indicate the level of regularity (or irregularity) in the urban system; through syntactic properties – local and global accessibility and the overall accessibility of the system; through the relationship between the parts and the whole – expressed as intelligibility and synergy; and through the land use activities generated in the spatial configuration. The analysis is conducted on a series of maps that depict the most characteristic stages of its development:

- Cadastral map dating from 1937;
- Cadastral map dating from 1981;
- Up-to-date cadastral map.

The following plans will be analyzed in addition to the cadastral maps to further explain the course of Tetovo's development:

- Compilation of the 1960s and 1970s urban plans;
- Compilation of 1990s urban plans.

The current plans are not taken into consideration since they are almost identical to the 1990s ones and do not cover the whole area of Tetovo yet.

5. Morpho-syntactic Properties of the Development Stages of the Spatial Configuration of Tetovo

5. 1. Geometric Properties: The most obvious difference between cities lies in their geometric features (Hillier, 2001). And the reasons behind those differences are cultural or social nature. According to Hillier's research on cities from different geographical and cultural areas (Table 3), societies have their particular cultural habits that are reflected in the spatial organization of the environments they inhabit (Hillier, 2001).

The different socio-economic conditions under which Tetovo developed during the centuries are also reflected in the geometric properties of its spatial configuration. The irregular and curvilinear streets of organic Tetovo (that evolved until WW2) result in a shorter axial line average length (Table 2). Although “the axial maps of cities are made up of a small number of long lines and a large number of short lines” (Hillier, 2001, 6), the short length of the axial lines and the low number of lines that run from the center of the settlements to their limits are one of the most important geometric features of cities with Islamic background (Hillier, 2001, 4). According to Hillier, the greater fracture, i.e. the small average length of the axial lines of Arab cities, compared to European or American cities, is a consequence of their specific cultural laws. In Arab cities, the stranger is encouraged to reach the center but is discouraged to navigate through the neighborhoods. On the other hand, the European city is more tolerant of strangers, thus the street network is more permeable (Hillier, 2001). A similar geometric structure to cities with an Islamic background is also present in organic Tetovo. Having said that, due to Tetovo's multicultural background, the comparisons should be taken with a certain degree of caution. Yet, similarities are obvious. The only two axes in Tetovo that reach the center of the settlement during this pre-war period are the roads that lead to the neighboring settlements - the road to Gostivar (“Ilindenska” Blvd.) and the road to Skopje (“Illyria” Blvd.), which will later become the city's main development axes. However, lines of the second rank length (probably due to topography) appear at the foothills, connecting the oldest part of Tetovo to neighboring villages (Figure 10).

The analysis of the spatial structure represented in the map dating from 1981 shows a drastic reduction in axial line length. At first glance, the appearance of the lowest average axial line length values seems contradictory, since new citywide lines (streets) are introduced based on the 1960s and 1970s planned structure (Figure 11). This is primarily due to the slow and unfinished implementation of the post-WW2 plans, partial penetration of certain streets through the existing urban fabric, and the intensification of the street network because of the population growth. Another reason is the dendritic street pattern (on collective

housing zones) implemented a step ahead of the orthogonal street pattern (on individual housing zones), even though both patterns appear on post-war plans simultaneously.

As Tetovo continues to expand and grow, the street network continues to intensify further. Gradually, with the completion of the orthogonal street network on individual housing zones on the outskirts of the city and the penetration of newly planned streets through urban blocks (both on the basis of the plans of the 1960s and 1970s and on the basis of the plans of the 1990s), the current street network is gradually gaining a higher average length of axial lines, and thus showing a tendency to develop from a relatively broken to a relatively geometric spatial configuration (Table 2).

Table 2. Geometric and syntactic properties of Tetovo

Map/ Year.	Segm. Av.	Av. Line	Connect.	Loc. Int.	Glob. Int.	Intelligibility	Sinergy
1937	43.17	130,8	3,407	1,962	0,762	0.134174	0.210035
1960s/ 1970s plans	42,80	211	3.938	2.187	1.176	0.368892	0.503292
1981	42,42	120	3.135	1.861	0.937	0.173533	0.348514
1990s/ plans	56,81	179	3,635	2,07	1,043	0,276004	0,428221
Current	46.49	135	3.128	1.865	0.942	0.16896	0.348514

Table 3. Geometrical and syntactic properties of four regional group of cities according to Hillier (2001)

Region	Cities	Avg. Line	Connectivity	Loc. Int.	Glob. Int.	Intelligibility
USA	12	542o	5.835	2.956	1.610	0.559
Europe	15	503o	4.609	2.254	0.918	0.266
Arab	18	84o	2.975	1.619	0.650	0.160

5. 2. Syntactic Properties: The longest lines (streets) "Ilindenska" Blvd. and "Illyria" Blvd. (former "M. Tito" Blvd.) are Tetovo's main integrators. However, both axes gained their strategic position within the city as it expanded, and particularly with their establishment as the principal axes of post-WW2 development. The 1937 processed map reveals "Princess Jelena" street (later "Strasho Pindzur"), "Prince George" street (later "T. C. Merjan"), and "King Peter" street (later "I. L. Ribar" or "the road Tetovo-Jazince" that leads to Kosovo) and "Nediceva" street (later "K. J. Pitu") as the most accessible. They are also part of the integration core with the bazaar at its center (Figure 10b). "King Petar" street along with "Svetosavska" street (later "G. Delchev") represents the main movement routes in Tetovo (Figure 10a).

The analysis of the spatial configuration that reflects Tetovo's development up to 1981 (Figure 12), which is very similar to the current one, reveals that the syntactic values of spatial entities also change with the expansion of the city and its spatial network transformation. As the street network is constantly intensifying and new streets have been added, particularly in the center, the integration core now takes a convex shape – a principle already found in city centers by Siksna and Hillier (Hillier, 1999) - and shifts first to "Ilindenska" Blvd. and then to "Illyria" Blvd. (Figure 12 and Figure 14). "B. Toska" Blvd. is also emerging as a potential new route within Tetovo's main movement distribution network.

Findings derived from the geometric analysis of the development stages of Tetovo's spatial structure presented in the previous section of the paper are also reflected in their configurational properties (Table 2). Tetovo's organic network system has a low average global integration value (0.762), which corresponds to the average global integration value of Arab cities (Table 3). The average global integration value indicates the number of intervening spaces that need to be passed to reach all other areas in the city. However, later stages of development show a certain increase in the average global integration values, similar to European cities (Table 3), i.e. 0.937 for the spatial configuration of Tetovo in 1981, and 0.942 for the one to date. There is a clear tendency towards the transformation the city's organic less accessible spatial configuration into a more accessible modern urban configuration. Part of the reason for this trend of increasing accessibility of the system lies in the 1960s and 1970s planned configurations which reaches

1.176, somewhere between the global accessibility values of the European (0.918) and American cities (1.610) (Table 3).

At the local level, at first sight the opposite happens (Table 2). The syntactic analysis of the 1937 map shows higher values of average local accessibility (1.962) compared to those of 1981 (1.861) and the ones to date (1.865). The system is gradually becoming locally segregated, despite the high values of average local integration (2.187) present in the 1960s plans which were supposed to guide the development after the war. It seems that Tetovo evolves through a double process. On the one hand, it is becoming globally integrated and, on the other hand, locally segregated. Again, the reasons for this phenomenon are to be found in the intensification of the street network and the emergence of new cul-de-sacs which provide access to newly created parcels within the urban blocks, as well as in the failure to penetrate new planned streets through the urban blocks. However, if we analyze the 1990s planned structure and their average local accessibility (2.01) and considering that these plans are used as a background for the preparation of new ones on the basis of which the city should continue to develop, we can assume that despite the current low average values of local integration, the city will continue to develop into a locally more accessible model.

5. 3. Parts and whole relationship: As a consequence of its transformation throughout history, apart from the global and local configurational changes, the relationship between the parts and the whole of the spatial configuration of Tetovo is also changing. This relationship between the parts and the whole is expressed by a correlation between global integration values and connectivity values, and by a correlation between global integration values and local integration values. The former relationship represents the degree of *intelligibility* and shows how much information about the overall urban structure is given by the local parts of the city, while the latter relationship-*synergy* indicates the potential for social interaction (Arruda Campos, 1997).

Intelligibility values presented in table 2 are $R = 0.134174$ for the organic spatial configuration of Tetovo (Figure 10e), $R = 0.173533$ (Figure 12e) and $R = 0.16896$ (Figure 14e) for the spatial configuration of 1981, and the one to date, respectively. Compared to the intelligibility values shown in Table 3 drawn from Hillier's analysis (Hillier, 2001), the similarity with Arab cities becomes more apparent. On the other hand, illegibility values derived from the syntactic analysis of the 1960s and 1970s planned spatial structure - $R = 0.368892$ (Figure 11e) and the ones from 1990s - $R = 0.276004$ (Figure 13e) are much higher, and they belong somewhere between European and American cities' intelligibility values (Table 3).

So, the correlation analysis between local and global configurational values reveals that the spatial configuration of Tetovo through its development stages shows quite small tendencies to switch from a labyrinthine system in which people cannot process information about the city as a whole based on the local surrounding, in a relatively legible system. Had Tetovo developed fully based on the 1960s and 1970s and, to a lesser extent, based on the 1990s planed structure, the leap from one labyrinthine system to another legible system would have been more significant. However, although the implementation and execution of the plans was slow, they still had an important impact on the intelligibility of the spatial configuration of Tetovo.

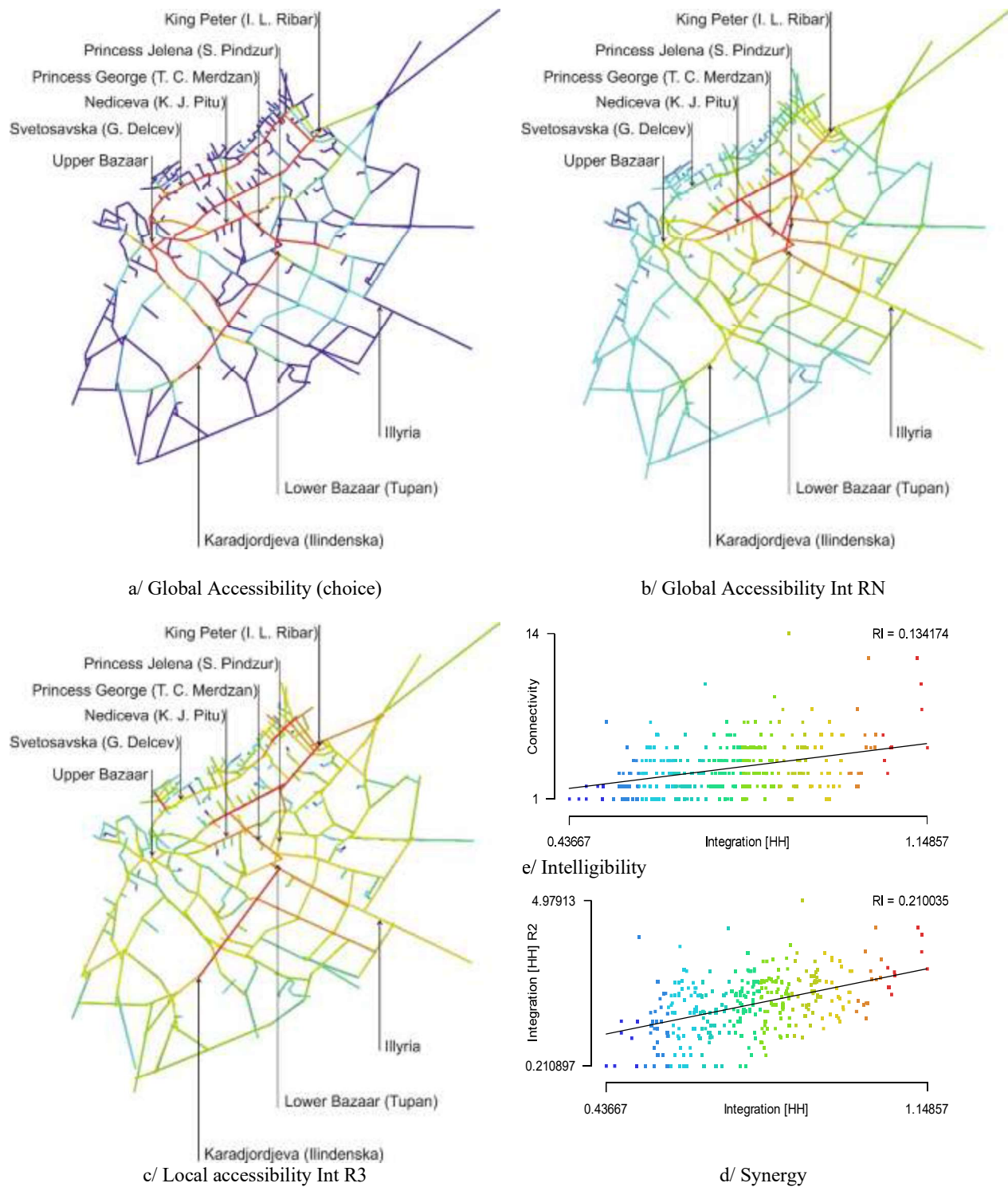
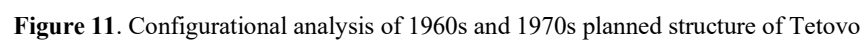
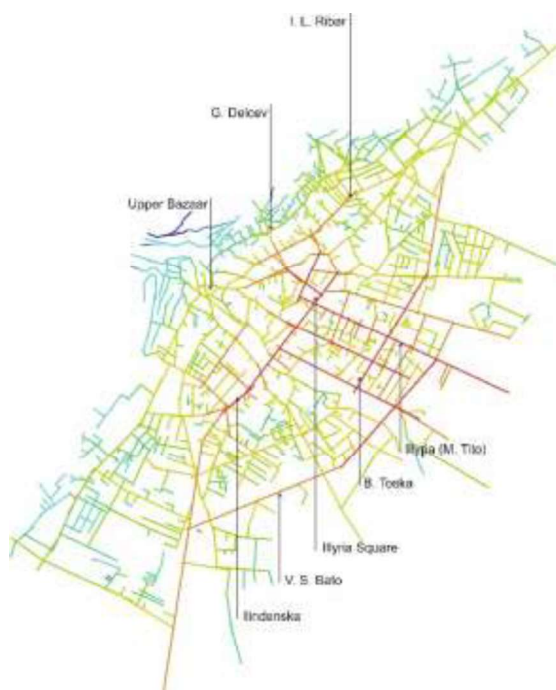


Figure 10. Configurational analysis of Tetovo - 1937

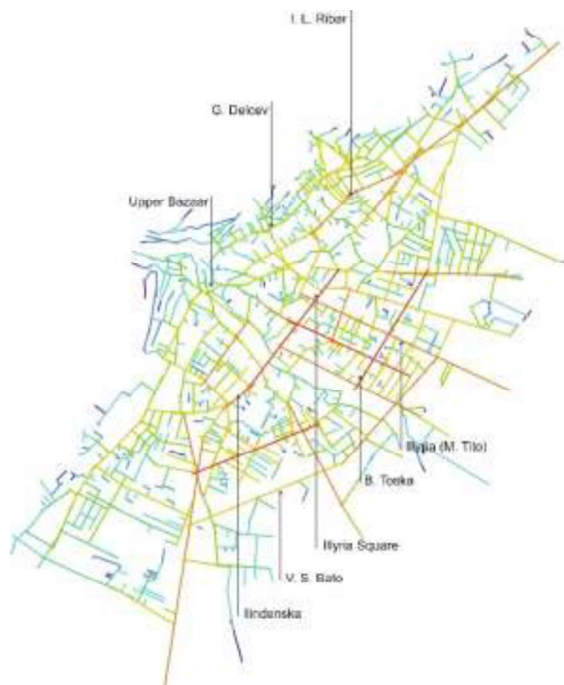




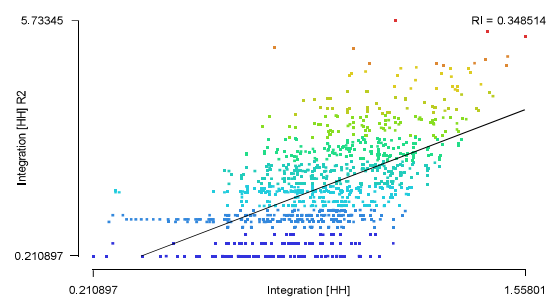
a/ Global Accessibility (choice)



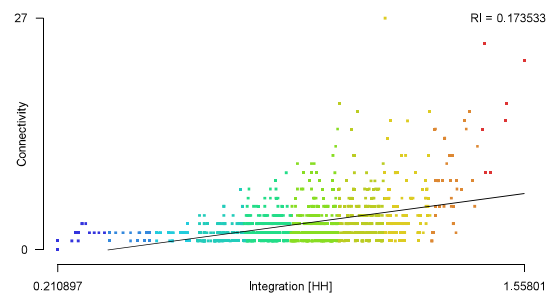
b/ Global Accessibility Int RN



c/ Local accessibility Int R3



e/ Intelligibility



d/ Synergy

Figure 12. Configurational analysis of Tetovo - 1981

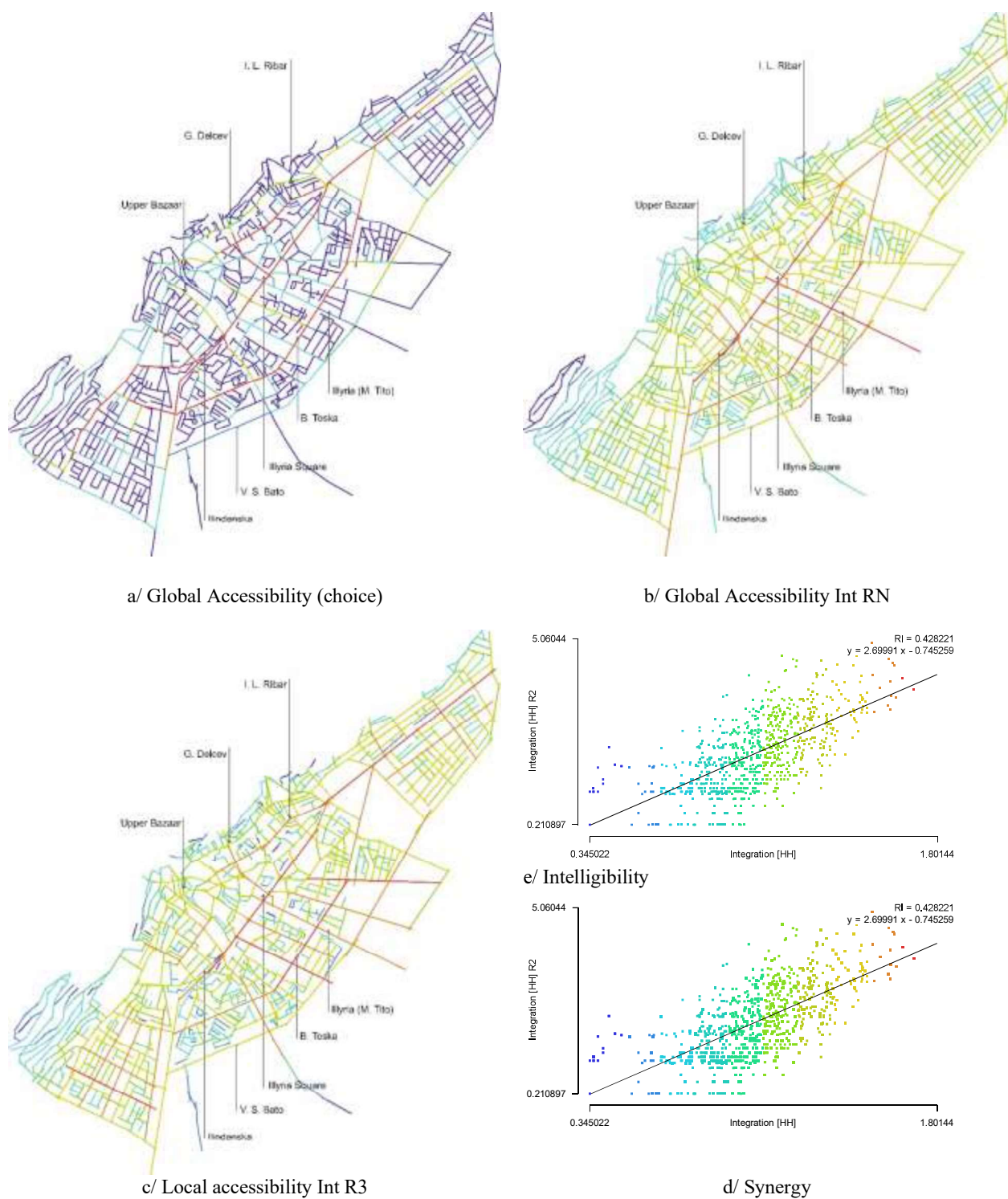
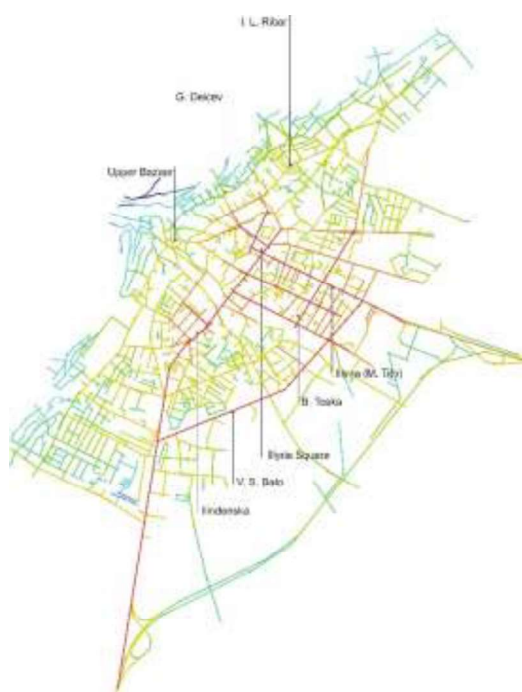


Figure 13. Configurational analysis of 1990s planned structure of Tetovo



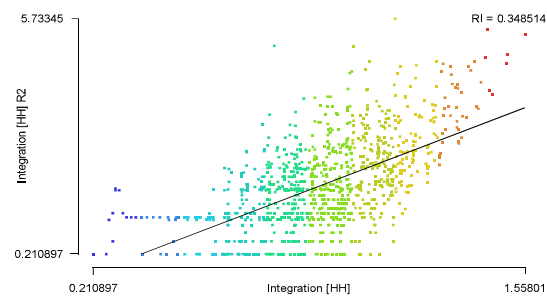
a/ Global Accessibility (choice)



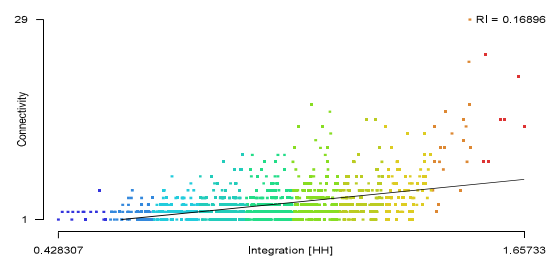
b/ Global Accessibility Int RN



c/ Local accessibility Int R3



e/ Intelligibility



d/ Synergy

Figure 14. Configurational analysis of current spatial structure of Tetovo

5. 4. Land Use Activities: With no real-time data, it is difficult to carry out a comprehensive analysis of the land-use activities that appear throughout Tetovo at all stages of development. However, to track and analyze the land use evolution and their relation to the spatial structure of the city, the concept of the primary elements of Aldo Rossi (Rosi, 1996) and in similar fashion Karimi's research on cities in Iran and UK (Karimi, 1997) prove to be helpful. The primary elements are the principal physical structures or open spaces where the city's main activities take place. They are generators and attractors of movements which, over time, participate in the development of spatial configuration and the development of the city. According to Rossi, these elements are able to speed up the process of urbanization of a city (Rosi, 1996, 117).

The bazaar is one if not the most important urban element in the cities of North Macedonia. Tetovo had two bazaars. Both the Upper and Lower bazaar occupy Tetovo's most accessible locations (Ferati, Saidi & Limani, 2019). The Lower bazaar with its main business and commercial activities is located at the integration core of the city (Figure 10b) and the Upper bazaar is located on the intersection of main arteries that lead to neighboring villages (Figure 10a). Hillier and colleagues were able to prove the correlation between the spatial configuration, movement, and land use activities (Hillier, Penn, Hanson, Grajewski & Xu, 1993; Hillier & Penn, 1996; Hillier, 1999). Movement seeking activities, usually commercial ones occupy the most accessible spaces in the cities, which on the other hand generate higher movement flows. The high correlation between movement seeking activities and spatial configuration in old Tetovo is best illustrated by Figure 15 depicting "Princess Jelena" Street (later "Strasho Pindzur") from 1929 and Figure 16 showing "Karadjordjeva" street (later "King Petra II" street or "Ilindenska" to date). While "Princess Jelena" is part of the integration core with a high concentration of physical structures and uses, "Ilindenska" Blvd. as shown above in Figure 10, is not yet part of the city's most accessible streets, resulting in less vitality and density of both physical structures and land uses.

Religion, as already mentioned, had huge political power and strong impact on the social and cultural dimension of the city during this pre-WW2 period. Religious buildings, whether Christian (churches) or Muslim (mosques), are also strategically located in the city, locally or globally, usually at the intersections or along major urban arteries, in order to increase their influence over a larger possible number of people (Ferati, 2012).

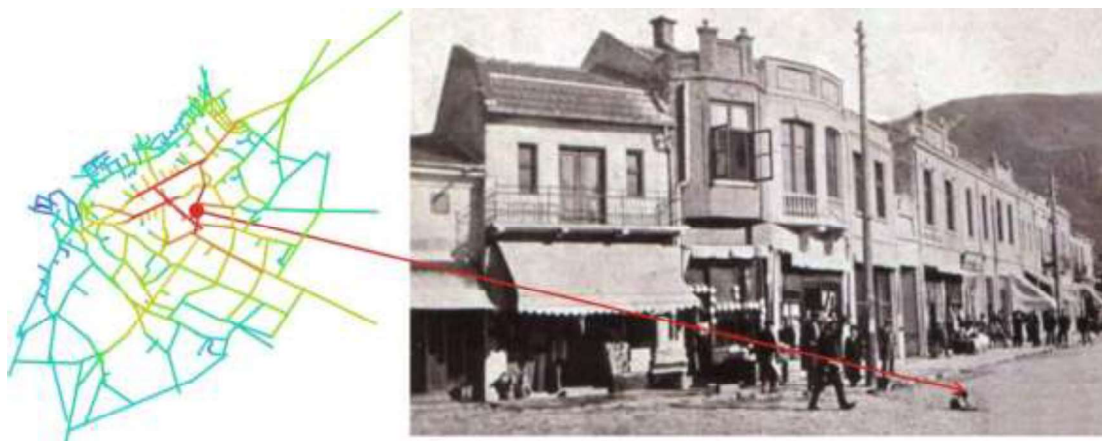


Figure 15. Crafts and shops in the center of Tetovo on Princess Jelena Street (Strasho Pindzur) from 1929. Adapted from *Тетовски споменар* (24). Светозаревик, Б., 1999, Тетово: Напредок.

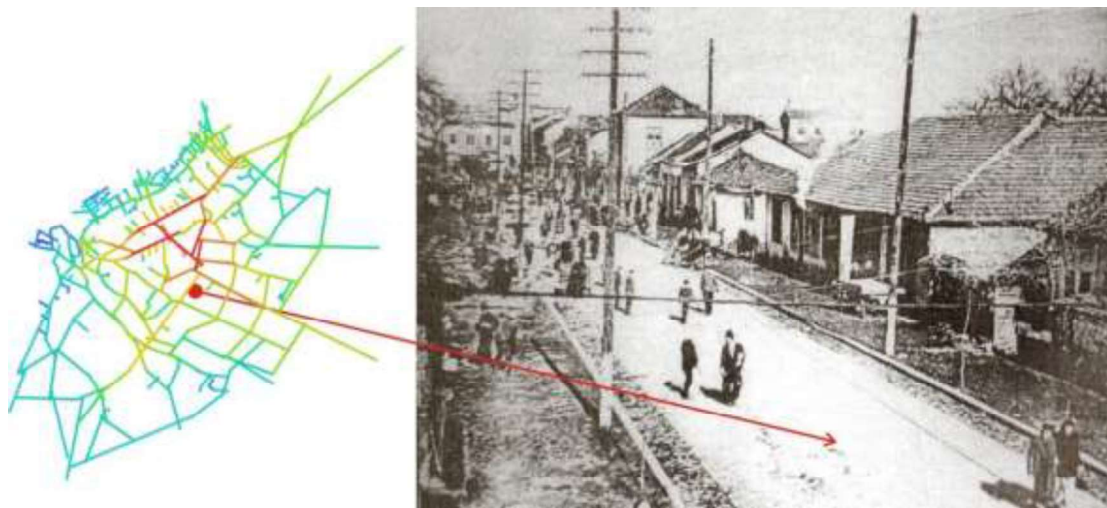


Figure 16. Karadjordjeva Street (Ilindenska Blvd.) from 1936. Adapted from *Тетовски споменар* (8), Светозаревиќ, Б., 1999, Тетово: Напредок.

The 1981 map reveals the level of transformations that Tetovo endured after WW2. Its central core has been transformed and the most vital urban element - the bazaar is no longer existing. Instead of the bazaar, a square and a cultural center were built because of the new post-war ideology and the new modernist planning principles. Though it was supposed to turn into a traffic junction-roundabout, the Upper Bazaar remained untouched by these megalomaniac actions, mostly due to the slow implementation of the planning policies. It still functions to some extent as a hub for socio-economic activities. In the absence of the bazaar as the main spatial entity for the economic and social transaction, an open market emerged on "Ilindenska" Blvd. which was already the main axis of the development of the city and the main system integrator (Figure 12) with probably the highest movement frequency.

As the city continues to evolve, activities have further intensified not only along "Ilindenska" Blvd. but on other routes that gained accessibility as well. The open market, which is now replaced by a shopping center on "Ilindenska" Blvd. (Figure 17), was moved to "Illyria" Blvd. which is the Tetovo's second most accessible route (Figure 14). A wide range of activities such as commercial, public, administrative, and catering facilities is also present on "Illyria" Blvd., all depending on frequent pedestrian flows. On the other hand, some of the main distribution arteries, such as the "V. S. Bato" Blvd. which has gained higher integration values and mainly distributes motor traffic, accommodate commercial activities suited for fast street transactions (Figure 18).

At all stages of development, the neighborhoods or residential areas are in the quieter parts of the public space network. But, in organic Tetovo, they are ingrained into the urban fabric, whereas the new parts which appear after the war are usually segregated and divided into separate housing enclaves.



Figure 17. Shopping center on "Ilindenska" Blvd.



Figure 18. Commercial activities on "V. S. Bato" Blvd.

6. Conclusion

The research shows that the spatial configuration of Tetovo evolved into:

- Irregular organic form until the end of WW2;
- Both irregular organic and relatively regular geometric spatial configuration after WW2.

The configurational analysis of the organic spatial configuration of Tetovo shows that, despite its long-standing reputation as chaotic and disordered, it is characterized by a complex order. Findings indicate that the spatial structure of organic Tetovo was relatively fractured, less linear, less accessible and less intelligible although the analysis is limited to the latest period of organic growth based on the earliest available map dating from 1937. Moreover, the study indicates that organic Tetovo has geometric and syntactic values like the values of the cities with an Islamic background, nevertheless additional research is necessary due to its multicultural background. However, similarities are obvious. Only a few long routes i.e. streets that link Tetovo to neighboring settlements penetrate the city from the periphery to the center. These routes are the most accessible ones in the network of public spaces, as well as the main arteries that distribute movements across the city. As such, they had a greater potential to generate encounters and possible interactions. To maximize the benefit of this potential, the bazaars emerged as social and economic centers at their intersection. The emergence of both bazaars and other movement seeking activities at strategic locations on the foreground network of public spaces indicates the hidden regularities of the organic structure of Tetovo. The Upper Bazaar was the center of Tetovo at its earliest periods of development on the foothills. As the city evolved and grew towards flatter areas, the integration core and the main routes began to shift, and the Lower Bazaar eventually emerged as the new center. On the other side residential zones appear in the background of the network of public spaces.

After WW2, modern planning policies and principles as well as gradual socio-cultural transformations influenced the continuous growth and development of Tetovo. Its spatial structure became slightly more accessible, more intelligible, and more geometric with a longer average line length. This trend is expected to continue, judging from the city's current development plans which largely incorporate presented solutions in the 1990s planned structures. During the post-war steady period of growth, the integration core shifted towards the main arteries ("Ilindenska" Blvd. and "Illyria" Blvd.) reinforcing them as the main system integrators. At the same time, these two arteries are relieved at a certain level from traffic since new concentric routes ("B. Toska" Blvd. and "V. S. Bato" Blvd.) are emerging as important system integrators and movement distributors. Consequently, these main arteries are accompanied by a wide range of mixed-use activities. There is a high correlation between the spatial configuration and activities throughout all stages of Tetovo's development despite the post-WW2 and to some extent the current planning policies that neglected the city's operating dynamics and caused a certain level of asynchrony between the spatial configuration and activities. Nevertheless, the simultaneous emergence of many informal structures and activities that tend to better correlate with the spatial configuration of the city has reduced the disorders caused by planning. The appearance of these informal phenomena and the regularities shown on the organic spatial structure indicate that behavioral patterns must be considered before new planning strategies are proposed. Both bottom-up and top-down approaches should be merged into planning policies.

This paper also suggests further investigation of other cities in North Macedonia or even in the Balkans to understand their general and specific socio-spatial characteristics. Thus, a comprehensive picture of the nature of the cities in the region would be generated. As such, it should serve as a sound foundation for new city planning policies. It would also be interesting to investigate the differences, if any, between the spatial configurations of residential units - mahallas with a different religious or ethnic background in the organic urban fabric of Tetovo in particular and in other cities of North Macedonia in general.

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