THE RELATIONSHIP BETWEEN THE GOVERNMENTAL AND SYNTACTIC CORES: THE CASE OF TRIPOLI, LIBYA

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Abstract. This study examines the relationships between the governmental cores composed of the governor’s palace and the buildings of ministries, and the syntactic cores composed of the most integrated spaces defined using the ‘Space Syntax’ techniques, over three historical phases of Tripoli, Libya: the early, colonial, and postcolonial phases. Tripoli was chosen for the study because each of its historical phases was distinguished by different political, social, and/or cultural systems. The early phase represented the Islamic systems; the colonial phase represented the Italian and British systems; and the post-colonial phase represented the regional-modern systems. The study looked at the relationships between the governmental cores and the syntactic cores of the city by overlapping the public/governmental buildings with the syntactic structures of the axial maps of six morphological frames (or maps) representing six morphological periods – two frames for each historical phase of the city. In the study, a close relationship between the governmental and syntactic cores was observed. During the early and colonial phases, the city had same governmental core but different syntactic cores. In contrast, during the post-colonial phase the city had different but overlapping governmental and syntactic cores. The study is important for it helps explain the role of the governmental and syntactic cores in the formation and transformation of the city over time. As a result, the study also helps explain the relationship between functional morphology, which examines the relationship between function and structure, and the spatial morphology, which examines the relationship among the spaces of a structure.

1. PUBLIC BUILDINGS AND GOVERNMENTAL CORE IN TRIPOLI

In each new political phase from the 17th through the 20th century in Tripoli, Libya (Figure 1), the governor’s palace was relocated to the edge of the city. These relocations were followed by important changes in the distribution of the public buildings and spatial structure of the city. This phenomenon raises the issue of the importance of the relationship between the public buildings, particularly the governor’s palace, ministries, and related buildings that comprise the government-buildings core, the distribution of the other public functions, and the spatial structure of the city. Whereas the government-buildings core represents the highest level of the political hierarchy in the city, probably it also represents, regulates, or influences the functional distribution and the spatial structure of the city based on the hierarchy.
The urban transformation of cities is a complicated phenomenon because it is based on several variables, such as time, form, and function, and their relationships. Since the 1970s, many studies of urban morphology have made many contributions regarding the transformation of one or two features (example, Kayvan, K., 1997; Peponis, J., 2009; Kubat, A. S., 1999). Fewer studies have highlighted the underlying relationships among different morphological features using several morphological frames (example, Rashid and Shateh, 2012).

This study is important, for there is a need for a practical and logical interpretation of the relationship between the different variables embodied in the urban structure that may have been responsible for regulating the transformation of the physical structure and urban pattern. Within this context, using a combination of three methodologies, this study examines the impact of the transformation of the public buildings, specifically the government-buildings core, on the urban transformation of the city.

First, the methodology of historical morphology is used here to identify the political impact on the functional distribution and structure over time. Second, the methodology of functional morphology is used to examine the redistribution of the public buildings in the structure. Third, the methodology of spatial morphology is used to examine the spatial characteristics of functional distribution. This combination of methodologies was designed to study the public buildings of Tripoli in terms of when and where they were built by connecting their geographical locations to the spatial structure. It uses the techniques of ‘Space Syntax, to describe the spatial characteristics that connect the whole city and provide an alternative way to re-examine the relationship between the public buildings and city growth.

Figure 1. the morphological frame of Tripoli during 1929 (After L.Y Berfareill, Guide d’Italia del Touring Club Italiano, Possedimenti e Colonie (Milan: Touring Club Italiano, 1929) (B. McLaren, 2006, p. 21).

2. SPACE SYNTAX AND SYNTACTIC STRUCTURE

Space Syntax is a set of theories and techniques used to describe the spatial structure of the built environment (Hillier & Hanson, 1984) in order to understand and validate its urban
functions and characteristics. Space Syntax was conceived in the 1970s by Hillier and his colleagues at University College, London. One of the Space Syntax techniques used to describe the urban structures is called an axial map. An axial map is defined as the least number of longest straight lines (also known as axial lines) that cover all streets and open spaces of an urban structure. An important advantages of this technique is to provide a quantitative and spectrum description of the spatial characteristics of a built environment.

Figure 2 simplifies graphically the three main steps of how Space Syntax expresses the spatial structure of an axial map mathematically. Whereas Figure 2-A is a spatial structure defined by a number of building blocks, Figure 2-B is the axial representation of the spatial structure. The connection pattern of an axial map allows calculation of a number of syntactic measures such as the connectivity, integration, and intelligibility values of each line or their average.

The connectivity value is calculated based on the number of lines that are directly connected to a line. Thus the connectivity value of an axial structure (Mean Conn) is the average of the number of connections (intersections) of all the axial lines in the axial map. The correlation between the connectivity and integration values provides another syntactical parameter called intelligibility or (r2). Intelligibility measures to what extent the space is intelligible from the other spaces in the structure.

![Figure 2](image)

\(Figure\ 2\), shows an example of using the axial-map technique of representing a spatial structure and the justified graph approach of calculating the integration value of the axial lines manually (After (Rashid & Shateh, 2012))

The integration value can be calculated using a calculation approach called justified graph, which is a reorganization of each line based on its depth from each of all the other lines in the structure. That is, the transition from one space to any of the next-connected spaces is considered one syntactic step away. All the spaces that are directly connected to the original
space will be located also at one step away. Similarly, to move forward from any line located at the first step, or at depth one, to the next connected line(s) is considered two steps away and so on, respectively, until reaching the last line in the network. Figures 2-C and 2-D show two examples of how to use the justified graph to calculate the mean depth values of two random spaces in the axial structure. The integration value of an axial is an algebraic function of its mean depth value. The average of the integration values (Mean Int-Rn) is one of the syntactic measures that describe the average integration value of all the lines from each other in an axial map. In the colored syntactic representation of an axial map, the spaces that have the highest integration values represent the most integrated spaces and are colored red; and the spaces that have the lowest integration values represent the most segregated spaces in the structure and are colored blue. The set of the most integrated spaces in the axial map define its syntactic core. The syntactic structure description is a practical approach to re-describe the functional distributions based on their location on the syntactic structure and is convenient for this study for tracking the historical and functional morphologies relative to the spatial morphology of the city over time. It provides quantitative and spectrum evaluations of the functional distribution of the public buildings since they are located on streets/spaces. This technique is applied to analyze the six maps of Tripoli representing the six morphological phases of the city. The mean connectivity, integration, and ineligibility values of Tripoli during the early, colonial, and postcolonial historical phases are provided in the Table (1) and discussed later.

3. The Historical, Functional, And Spatial Morphology

3.1. BRIEF URBAN HISTORY OF TRIPOLI

The history of Tripoli, Libya during the last three centuries indicates three political eras which were different in terms of their ideological, political, social, and cultural backgrounds. Based on these differences, the historical morphology of Tripoli can be divided into three phases: the early phase – from the end of the 17th century to 1911. This phase is distinguished by an Islamic political background, and the spatial structure and the distribution of the public buildings of this phase are represented by the morphological frames of 1890 and 1911 (Figures 3 and 4). The colonial phase, from 1911 until 1951, represents the Italian and British periods, which were distinguished by the European backgrounds. The spatial structure and the distribution of the public buildings of the colonial historical phase are represented by the morphological frames of 1929 and 1943 (Figures 5 and 6). The post-colonial phase, from 1951 to the beginning of this century, represents the local political era. The spatial structure and the distribution of the public buildings of this phase are represented by the morphological frames of the 1980s and 2000s (Figures 7 and 8).

3.2. THE FUNCTIONAL AND SPATIAL MORPHOLOGY OF THE HISTORICAL PHASES OF TRIPOLI

In order to describe the relationship between the functional and the spatial morphology of the city, the public buildings are simply overlapped with the syntactic structures. This method is
used for the two morphological frames of each historical phase. Each of the six morphological frames is analyzed using radius-n integration values.

3.2.1. The Governmental and Syntactic Cores of the Early Phase

The spatial and functional analysis of the first morphological frame, or 1890s axial map, shows the syntactic core was represented by two spaces: (i) Jama el-Drouj and, (ii) Homat Garian Streets. Jama el-Drouj Street divided the city between the east (residential area) and the west (public buildings area/core). The northern area was the area with most of the public buildings, including: all of the shops and open markets, the Red Castle (Monument I), or the governor’s palace representing the governmental core, many mosques (Monuments 3, 13, 16, 25, 26, and 30 in Figure 3), Santa Maria Church (Monument 76 in Figure 1), and the consulates of different countries (Monuments 32, 34, 35, and 36 in Figure 3).

In addition to providing access to most of the public buildings, Jama el-Drouj Street was the main connector between the city gates, Bab al-Bahr (Monument VI) and Bab Bab al-Hurray (Monument IV), which provided direct control of the Red Castle through Bab al-Khundeg (Monument II) and Bab al-Menshia (Monument III). Homat Gerian Street, on the other hand, was one of the longest and straightest spaces and was the connection between the center of the commercial core and the south-western gate of the city, Bab al-Jadid (Monument V), through the residential area.

The spatial and functional analysis of the second morphological frame, or 1911 axial map (Figure 4), illustrates that Tripoli showed an important urban expansion next to the eastern wall that included residential buildings, a town hall, a hospital, a technical school (Amurah, 1998, p. 317), and a market (Monuments XII, XI, and X, respectively, in Figure 2). This market, known as ‘Suk el-Khobsa, or Bread Market, was connected to the commercial center of the old city through the gates of Bab al-Menshia and Bab al-Khundeg (Monuments II and III). However, the extension, which included a number of the new public buildings, did not affect the formation of the syntactic core as was defined by Figure 1. The new public-buildings core was constructed close to the old governor palace, Red Castle. The correlation between the governor palace and the transformation of the public-buildings core is what the study tries to investigate.

The spatial and functional distributions of the morphological frames of the early phase, show that (i) the syntactic core and the core defined by public-buildings were overlapped; (ii) the Red Castle (i.e., the Governor’s Palace) had a strategic location defined by straight and direct accesses to the most important monument of the city. This also gave the governor’s palace a strong position of control over the syntactic core, the public buildings’ core, and the city’s port, which was the most important military and economic point of the city. However, it is not clear yet if the spatial characteristics of the syntactic core pulled the public buildings to their current locations, or what the relationship was between the governor’s palace and the different cores.

3.2.2. Colonial Historical Phase and the Transformation of the Syntactical Core
The colonial phase of Tripoli is represented by the Italian and British colonial periods. Since the British did not implement important changes, the morphological analysis of this phase focuses on the Italian urban transformations which were conducted in two stages.

### 3.2.2.1. The First Stage: New City, syntactical Core, and distribution of the public buildings

The first urban-transformations, which were based on the 1912 master plan proposed by Luigi Luiggi, took place from 1912 to 1934 and is presented by the morphological frame of 1929 (Figure 5). The morphological analysis of the frame indicates that there was a new city distinguished by a new spatial structure, a new syntactical core, and a new distribution of the public buildings.

**New City and New Transitional Node:** The new city of Tripoli, which was based on the 1912 master plan proposed by Luiggi, followed the modern rules of urban planning in Europe (B. McLaren, 2006). The new urban planning system was distinguished by a radiating grid, with its center defined by a central open public space called the Piazza. “A public open space, Piazza Italia was created in front of the Red Castle, and a major public artery, Corso Vittorio Emanuele III, was built over the existing Sharah Aziza” (B. McLaren, 2006, p. 24). Aziza Street also was the spatial backbone of the urban expansion outside of Old Tripoli during this phase. The strategic location of Piazza Italia in the spatial growth of the old structure, its closeness to the governor’s palace – the Red Castle, and its location between the old and new structures of Tripoli, made it the most important open public space and the center of the new syntactical core and the new public buildings.

**New Syntactical Core:** Based on the syntactical structure (Figure 5), the syntactical core, or the most integrated spaces during the colonial period, were defined by three streets located in the new structure and were connected to the Piazza Italia: (i) Corso Sicilia was an important connector between Piazza Italia and a number of important monuments including the Oil Refinery and the rail station (Monuments 38 and 42, Figure 5). This street was also intersected by Manzoni and S. Omran Streets, which were important streets for the southwest monuments of Manif Tabacchi, or Tobacco Manufacturer, and the Power Station (Monuments 40 and 45, Figure 5). (ii) Via Palermo Street was connected to Piazza Italia at the end of Jama el-Drug Street, which was the most integrated space in the old structure and a part of the old commercial center. (iii) Via Bardia Street, in addition to its position as an important extension of the commercial area through the gate of the Red Castle (i.e., Bab al-Khundeg), provided important access between a new Governor's Palace (Monument 37, Figure 5) and Piazza Italia.
Figure 3. The distribution of the public buildings overlapped with the syntactic structure of 1890s produced using radius-n integration values.

Figure 4. Shows the distribution of the public buildings of the urban extension overlapped with syntactic structure of 1911-map (Baedeker's travel guide) which was edited by adding the spatial structure of 1980s axial map of the Figure 1.

The New functional Redistribution of the Public Buildings: As shown in Figure 5, the redistribution was focused on and around the four most integrated streets and their central node, Piazza Italia with the majority of the commercial, financial, and governmental buildings of the city. Even though a large area of urban structure was based on the European planning system, the Italians public-buildings core was concentrated on the Italian side of Piazza Italia, next to the Red Castle, because the Red Castle was used as the governor’s palace during the first colonial stage and the public buildings were needed to be located next...
to it. In this sense, the government-buildings core became the main force shaping the distribution of all the other important public functions in the city. This may also explain why the syntactical core had shifted from inside to outside Old Tripoli in this phase. Since the new public buildings along some of the most integrated spaces was responsible for intense development in the area, many other streets in the area became further integrated with the whole urban system. As a result, a new syntactical core was determined primarily by the public-buildings core of the city.

3.2.2.2. The Second Stage: Redistribution of the Government-buildings Core

The second stage of the urban transformation during the colonial eras took place from 1934 to 1943 and was based on the 1933 master plan proposed by the architects Alberto A. Novello, Ottavio Cabiati, and Guido Ferrazza (Figure 6). The syntactical analysis of this morphological frame presented in Figure 6 shows that the number of the public buildings and the number of the most integrated spaces from three spaces in the 1929 map (Figure 5) to six spaces in 1943 map (Figure 6). The three spaces are: (i) Corso Vittorio Emanuele III, or Aziza Street: (Figure 6). “This street, which had a decidedly metropolitan character, was defined by a number of significant public institutions, including a town hall, courthouse, cathedral, and new governor’s residence, thereby becoming the center of the Italian civic life” (B. McLaren, 2006, p. 24) (Monuments 27, 30, 36, 37 respectively, Figures 5). (ii) Lungomare Conte Volpi Boulevard or Zauiet Ed-Dahmani Street (Figure 6) becomes one of the most integrated spaces during the second colonial stage. This space was designed by Roman architect Armando Brasini as a wide boulevard to define the waterfront in order to create and express the Italian modern colonial power in Libya (B. McLaren, 2006). This boulevard was the place of the Miramar theatre, Bank of Italy, and Grand Hotel (Monuments 27, 28 and 35 in Figures 5 and 6).

Figure 5 the distribution of the public buildings overlapped with the syntactic structure of 1929-map produced using radius-n integration values.
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Figure 6, the distribution of the public buildings overlapped with the syntactic structure of 1943-map produced using radius-n integration values.

These buildings caused further developments in the area, as indicated by the construction of Tripoli Trade Fair and an Italian residential quarter in 1929 on Corsa Sicilia, resulting in a significant increase in the integration values of the street. The increase in the integration value was consistent with the increase in the number of the public buildings during the colonial period. (iii) The third spaces was V. L. Mercalelli Street, which was connected Corso Vittorio Emanuele III to Lungomare Conte Volpi Boulevard at the Catteddal (Monument 36, Figure 6)

Also during the period between 1934 and 1940, Italo Balbo continued the development of the infrastructure, parks, and public buildings, including the governor’s own office in 1939, next to Monument 29, (Figure 6) on the southern side of Piazza Italia. Therefore, this location of the syntactic core did not change. Later during the Italo Balbo period, a new governor’s palace known as Kingdom Palace, or Palazzo del Governatore (Monument 37), was located at the edge of the urbanized area on a segregated street about the middle distant between the Red Castle and the Italian wall. The new Italian wall surrounded the new city of Tripoli, or the urban structure, was built based on the European planning system and consisted of 12 gates starting from the Bab Gergarsh and ending at Bab Tagura (Monuments A through L, Figure 6).

3.3. THE POST-COLONIAL AND DIFFUSION OF THE SYNTACTICAL AND GOVERNMENT-BUILDINGS CORES

It took till the 1960s to urbanize most of the walled Italian city of Tripoli. The morphological analysis of the syntactical structure and the distribution of the public buildings during the post-colonial phase focused on the area of the walled Italian city of Tripoli and is presented using two morphological frames: first, the 1980s (Figure 7) and, second, the beginning of the 2000s (Figure The first morphological frame of the post-colonial phase (Figure 6) shows that there were significant transformations in the syntactical and public-buildings cores. The syntactical core moved from being around Piazza Italia to being around the new government-buildings core that included the Kingdom Palace and the Prime Minister’s Office (Monuments 2, 7, Figure 7). The Kingdom Palace, also known as the Royal Palace, was the
The governor’s palace of Libya only from the 1952 until 1964 when the capital was moved to another city. However, in late 1969, when the political system of Libya changed and the capital returned to Tripoli, the governor’s palace was relocated at the edge of the Italian wall at Bab-al-Aziziya Gate (Gate C, Figure 7).

During this phase, the commercial core defined by the banks, shops, and open markets, and the syntactic core around Piazza Italia started extending from Piazza Italia towards four monuments: Bab Gargaresh (Monument Gate A, figure 7) through Corsa Sicilia, Bab Tagiura (Monument Gate J) through Volpi Boulevard, the Kingdom Palace through Corso Vittorio, and Bab-al-Aziziya (Monument Gate C) through Via Piemonte. This growth of the commercial core occurred on the important accesses to the new governor’s palace. Even though most commercial activities was still located next to the urban structure of Old Tripoli, the integration values of the old structure had decreased because there were no important public buildings in Old Tripoli to sustain growth and development.

Figure 7. the distribution of the public buildings overlapped with the syntactic structure of Tripoli using radius-n integration values and the distribution of the public buildings during the 1980s.
The second morphological frame at the beginning of the 2000s (Figure 8) shows a diffused government-buildings core. The most important reason for this diffusion was due to the political system that ruled Libya from the beginning of the 1970s until the end of 2011. This political system depended on the continued redistribution of the governmental buildings, not only both at the local and the national level of Libya.

4. DISCUSSION & CONCLUSION

Fowler (1972) stated “when the Italians landed in Tripoli, they did not have a plan for it” (pp. 627-628). However, the morphological analysis of Tripoli during the colonial phase shows that Tripoli was exposed to systematic transformation resulting in a new city based on the model of European cities at the beginning of the 19th century. McLaren (2006) stated that “the goal was to modernize the region in order to make it suitable for a program of demographic colonization” (p. 21). Based on the functional and spatial morphologies of Tripoli, the systematic transformation to modernize Tripoli was conducted gradually during the colonial phase in two main steps.

In the first step, a transitional zone, defined by Piazza Italia, was created to help make the transition from the Islamic to the European systems. In the second step, the urban pattern was gradually Europeanized based on a redistribution of the government-buildings core within a grid structure. The study reveals that the governor’s palace and the government-buildings core helped shape the distribution of the public buildings. These public buildings, in turn, helped modify the spatial structure based on intense urban development and growth associated with them.

During the early phase, the syntactic core overlapped the government-buildings cores inside Old Tripoli. During the colonial phase, when the government-buildings cores were moved, the syntactic core also moved with it. However, the relationship between the two different cores was still not clear in terms of their influences on each other in the early Islamic and
colonial phases. This may have been because the morphological frames did not represent the early formative steps of the city sufficiently, and that the syntactical core during the early colonial phase was too close to the old syntactical core. It is also possible that the Italians were aware of the fact that the government buildings, due to their political importance, could instigate significant structural changes in the city. Therefore, they kept the Red Castle as the government-buildings core and, as a result, were able to put in place a smooth and gradual transformation of the local urban pattern to a new and different pattern.

In contrast, the historical and functional analyses of the late colonial phase show that the shift of syntactical cores form their old locations to the new location was indeed instigated by the shift of the governmental core. That is because historical evidence shows that the Kingdom Palace was constructed during the colonial phase at the edge of the urbanized area at the time when the syntactical core was still at the Red Castle. The spatial analysis of Tripoli during the colonial phase also shows that the Kingdom Palace was located on segregated spaces. In 1969, during the second political period of the post-colonial phases, when the governor’s palace was moved again to Bab-al-Aziziya, the government buildings were not moved to the area of the governor’s palace. As a result, no significant changes were observed in the syntactic core of the city.

The application of the European planning system caused significant transformation of the social structure defined by the changes in the local spatial order which presented by the syntactic measurements (Table 1). Even though Old Tripoli was distinguished by the grid planning system somewhat similar to the European planning system, table 1 shows that there were clear differences between old Tripoli during the early phase, and new Tripoli during the colonial phase in terms of the mean connectivity, integration, and ineligibility values. These differences might have been the result of colonial enframing of the spatial order. The steady changes in the mean connectivity, integration, and ineligibility values during the colonial and postcolonial phases indicate that the spatial pattern of the European planning system and the distribution of public buildings might have influenced further urban expansions in Tripoli (Table 1).

Overall, the study, using functional and spatial morphologies over a period of three hundred years, shows how the government-buildings core was used by different political systems as a tool to define and redefine the syntactic cores of the city for their purposes.

Table 1, shows the number of the spaces, mean connectivity, and global integration values computed for radius-n, and the intelligibility values of the six axial structures of Tripoli.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of space</th>
<th>Mean Conn</th>
<th>Mean Int-Rn</th>
<th>r²: Int-Rn vs. Conn</th>
</tr>
</thead>
<tbody>
<tr>
<td>1890s</td>
<td>463</td>
<td>2.810</td>
<td>1.00</td>
<td>0.284</td>
</tr>
<tr>
<td>1911</td>
<td>493</td>
<td>2.880</td>
<td>0.987</td>
<td>0.216</td>
</tr>
<tr>
<td>1929</td>
<td>566</td>
<td>4.948</td>
<td>1.494</td>
<td>0.397</td>
</tr>
<tr>
<td>1943</td>
<td>1186</td>
<td>3.666</td>
<td>0.894</td>
<td>0.242</td>
</tr>
<tr>
<td>1980s</td>
<td>3637</td>
<td>3.775</td>
<td>0.814</td>
<td>0.086</td>
</tr>
<tr>
<td>2000s</td>
<td>4601</td>
<td>3.964</td>
<td>0.904</td>
<td>0.121</td>
</tr>
</tbody>
</table>

In conclusion, using Space Syntax theories and techniques, the study provides new ways to study the relationships among the historical, functional, and spatial morphologies of the City of Tripoli. More specifically, by linking the spatial structure to the distribution of the
government-buildings core of the city in several morphological frames of the city, the study provides a new understanding of the relationship between functional distribution and spatial transformation. Using the methodology presented in the paper, city planners, urban designers and architects may be able to visualize any possible interaction between different morphologies of a city resulting from any design interventions in the city.

Notes:

• The syntactic structure of the Figure 3 was adapted from a map of the Old Tripoli prepared by the Organizational and Administrative Project of the Old Town of Tripoli, 2005-5, which represents the urban structure during the end of the 1890s, or the Ottoman era.

• The syntactic structure of the Figure 4 was adapted from the 1911 map produced by Wagner & Debes Cartographic Establishment for “Baedeker’s travel guide, which was authored and published by Ernst Debes”.

• The syntactic structure of the Figure 5 was adapted from the 1929-map in the Figure 1.

• The syntactic structure of the Figure 6 was adapted from ‘Map of Tripoli, 1:5,000, Army Map Service. U. S. Army. Washington. D. C., 114138 – 1943. Map collection, Anschutz Library. University of Kansas Library.’

• The syntactic structure of the Figure 5 was adapted from the 1980s- and 2000s-map related to the ‘Development Plan, Tripoli Region prepared by Policevice, Vadico, Warsaw Poland for the Urban Planning Office, Libya.

References


