

Applications of morphological regionalization in urban conservation: the case of Bulaq Abulela, Cairo

Aliaa AlSadaty

Department of Architectural Engineering, Faculty of Engineering, Cairo University, Giza, Egypt. E-mail: Aliaa_alsadaty@cu.edu.eg ORCID: 0000-0002-1831-5276

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Abstract. *The absence of a reliable tool to support local authorities in the process of boundary delimitation of significant urban areas is one of the major problems facing urban heritage conservation. This paper explores and introduces potentials of applying the concept of urban regions, and methods of urban regionalization, as a new approach to better inform processes of delimitation of significant urban areas in Cairo, Egypt. This is an important step towards urban conservation in a city where strong pressures of urbanization and the eradication of traditional and historic urban fabric represent a major threat. By tracing the morphological transformation of the historic quarter of Bulaq Abulela, then applying the morphological regionalization process to a selected area of study, several important historical urban gains that are not included within the national protection boundaries, are revealed. This calls for revisiting current local protection boundaries of the historic quarter, as well as a revision of the adopted local processes of protection boundaries delimitation in general. It also calls for the application of morphological regionalization in processes of boundary delimitation for urban conservation areas.*

Keywords: morphological regionalization, urban heritage conservation, protection boundaries, Bulaq Abulela (Cairo)

Increasing attention to maintaining the historic urban character of places has been reflected in the interest of countries to register their historical urban settings within local, national or international lists of significant places. Decision-making related to conservation boundaries is a complex process relating to conservation agents, agencies and governance from a variety of domains (Deng and Larkham, 2020). While it is commonly agreed that it is important to protect heritage fabric to maintain character, the process of how to delimit boundaries for these areas and decision-making processes related to which parts are to be conserved, are still far from being well informed (Deng and Larkham,

2020; Whitehand *et al.*, 2011). Conservation boundaries are usually delineated using approaches that mostly rely on basic cartographies, previous reconnaissance and personal knowledge (Larkham and Morton, 2011). Such a method is likely to lead to the overlooking of important areas of value or generating odd boundaries for planning policies.

Several studies have investigated the application of urban morphological approaches in the field of urban conservation (Imam, 2017; Larkham and Morton, 2011; Sjöholm and Hidman, 2020). Although fundamental underpinnings relating to conservation have been explored, the recommendations of academic research are rarely put into practice. This is

Table 1 Maps used for this investigation: those traced and illustrated in this study are shown in bold

Date	Title	Scale	Source
1810–20	Map of Bulaq	1:5000	Jomard and Jacotin (1818)
1847	Plan General de la ville du Caire	NA	Prisse d'Avannes (1982)
1874	General plan of the City of Cairo	1:4000	Grand (1874)
1897	General map of the city of Cairo	1:10,000	Ministry of Public Works (1897)
1909–12	Egyptian Survey Department	1:1000	Egyptian Survey Department (1909–12)
1920–21	General map of Cairo	1:15,000	Egyptian Survey Department (1920–21)
1948	Islamic Monuments of Cairo	1:5000	Egyptian Survey Department (1948)
1958	Egypt City Plans: Cairo	1:10000	(United States Army Maps Service (1958)
1980	Cairo Map	1:10000	Egyptian Survey Department (1980)
2020	Satellite image of Cairo	1:5000	Google Earth Pro

exacerbated in the Egyptian context where urban morphological applications are rarely employed to enrich urban studies in general and urban conservation in particular (Imam, 2017; Panerai *et al.*, 1999). Furthermore, urban morphological tools are absent in the Egyptian decision-making process when it comes to conservation area delimitation.

Structure and methods

To explore applications of the morphological regionalization process in urban conservation and boundary delimitation in Egypt, this study is organized into three sections. The first examines the status of heritage conservation in Egypt, and the processes used to delimit urban heritage protection boundaries. The second focuses on the concept of morphological regions and methods of morphological regionalization. The third focuses on Bulaq Abulela (hereafter Bulaq), a historical area developed around the thirteenth-century port of the city. Bulaq, which developed outside the city walls, has been always a part of historic Cairo but separate from it. The examination of Bulaq is in two parts: first an examination of its morphological transformation at the macro-scale, then an application of the morphological regionalization process on a selected local area of study within Bulaq.

For the morphological transformations of Bulaq, the study relies on the analysis of archival material, historic maps, and satellite

images. A total of ten historic and satellite maps covering 200 years from 1820 to 2020, with scales ranging between 1:4000 and 1:15000, were consulted. Six maps are then overlaid with the same scale to trace the major morphological transformation of Bulaq (Table 1). The reading of Bulaq's cartography is supported with archival sources that describe the history of Bulaq in each era. Current administrative boundaries as well as current protection boundaries of Bulaq are overlaid on all investigated maps to allow tracing the transformations in relation to current boundaries, which helps in identifying the local area of study within Bulaq.

The local area of study was selected based on the following criteria: a) it is part of the historic development of Bulaq that has maintained major features of its urban tissue throughout the morphological transformations that occurred on the macro-scale; b) it is located within the administrative boundaries of Bulaq; c) it is located outside Bulaq's current protection boundaries.

After selecting the local area of study, site visits and plot-by-plot surveys were undertaken during July-September 2020 to outline the existing three basic form complexes on separate maps, necessary for the identification of morphological regions. The three basic form complexes are, first, plan units, showing areas that are homogeneous in terms of street layout, plot patterns, and building blocks plans. This is concerned only with the two-dimensional level. Units are mapped using boundaries with various thicknesses,

referring to a hierarchy of orders. Secondly, building types/forms, dealing with the third dimensional level which is concerned with the categorization of the physical forms of buildings. Thirdly is land use. Following the standard practice, the three maps are then integrated into the morphological regions map (Birkhamshaw and Whitehand, 2012; M. P. Conzen, 2004). The outcome reveals different urban historic grains, which in turn can inform local authorities in their decisions to review and readjust protection boundaries.

Urban heritage conservation in Egypt

Monuments and architectural and urban heritage in Egypt are protected under three laws and their executive regulations. The first is the Antiquities Protection Law (117/1983), which controls nationally-registered monuments. The second is the Law Regulating the Demolition of Non-Dilapidated Buildings and Establishments, and the Preservation of Architectural Heritage (144/2006), concerned with protecting buildings that do not meet the criteria to be listed as monuments but that are linked with a 'peculiar value' (Egyptian Government, 2006). The third is Section 2 added in 2008 to the Unified Building Law (119/2008), concerned with 'urban areas of value'. According to this section, the National Organization of Urban Harmony (NOUH) is responsible in dealing with areas of peculiar values and in the delimitation of their protection boundaries. NOUH also proposes legislations and development guidelines to maintain character in these areas (Egyptian Government, 2008).

Urban areas of value are designated by a committee from NOUH, which then proposes protection boundaries for the area. The designated areas and their proposed protection boundaries must then be approved by the Supreme Council of Planning and Urban Development. Area boundaries are delineated by the committee based on their urban value as well as the degree of concentration of buildings of value. The urban value can be implied in the peculiarity of urban fabric, in the area's

historic development, or links with a distinguished urban planner. For Historic Cairo (although not for all other areas of value), areas are classified in three categories: A, B or C, and an overlap zone between historic and Khedival Cairo. These category zones have common general regulations and guidelines concerning character, urban tissue, modification and restoration of buildings, but different regulations are applied for new buildings. Differences mainly concern the permitted heights of new buildings, and percentages and proportions of fenestration. These regulations are tailored to the character of each area of value. A part of Bulaq is currently listed as part of Historic Cairo, category C. The boundaries were delineated by NOUH and approved by the Supreme Council of Planning and Urban Development in 2009 (National Organization of Urban Harmony, 2009) (Figure 1).

Morphological regions – morphological regionalization and urban conservation

The historico-geographical approach has been recognized as one of the most important approaches to study urban morphology. Within this approach, the concept of morphological regionalization has been widely accepted as a valid method to read the structure of an urban area (Oliveira and Yaygin, 2020). The concept of morphological regions was coined by M. R. G. Conzen (1960). Morphological regional mapping is the integration of plan units, building types, and land utilization. Thus the concept of morphological regionalization is about how the various layers of an urban area work together. It is about the ensembles rather than the individual buildings (Gu, 2019).

The process of morphological regionalization was elaborated for a better understanding of urban transformations, development, growth, and diversity (M. P. Conzen, 1990; Whitehand, 2001). The identification of morphological regions helps in detecting the stratification of historic periods which often produce homogeneous plan units.

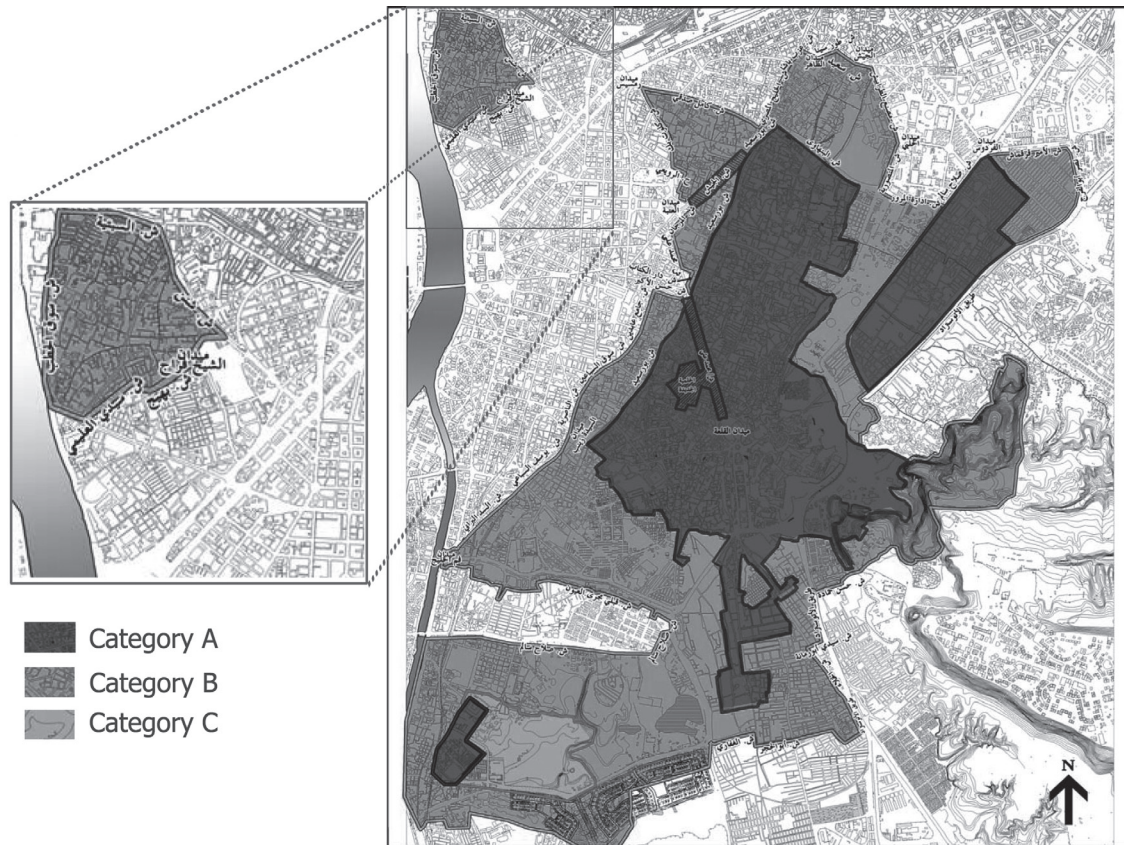


Figure 1. Boundaries of Historic Cairo, showing Bulaq at the upper left corner (source: The National Organization of Urban Harmony, 2009).

Since the outcome of the morphological regionalization analysis provides insights into historic urban grains, various benefits can be inferred in fields including urban design, urban conservation, regeneration, and urban management, among others (Oliveira, 2019; Whitehand, 2009). The literature includes the application of the concept of morphological regions in contemporary planning issues including maintaining character and conservation (Larkham and Morton, 2011; Whitehand, 2009). Oliveira and Yaygin (2020) illustrate the main applications of the concept over six decades, showing the richness of its contribution and major common uses, but highlighting also the challenges for a more effective regionalization. Extensive work has also been undertaken in investigating the concept in the conservation and redevelopment of historic urban areas in China (Gu, 2019; Whitehand and Gu, 2007; Whitehand *et al.*, 2011).

The case of Bulaq, Cairo: morphological transformation (1820–2020)

Bulaq's history dates back to the turn of the thirteenth century (Abu-Lughod, 1971). It was established on a natural alluvial plain formed by the gradual westward movement of the course of the River Nile (Lane-Pool, 1902). Bulaq flourished during the Mamluk and Ottoman periods as a distinct satellite town and a main port outside Cairo's city walls. Due to strong ties between Egypt and the Ottoman Empire and Europe, the Port of Bulaq gained importance as Egypt's gateway to the Mediterranean (Raymond, 2001). Hence Bulaq underwent massive urban growth (Hanna, 1983). Bulaq includes historic significant caravanserais, mosques, fountains, public baths, palaces and upper-class suburban houses (Hanna, 1983). The urban tissue of Bulaq is of no less importance than its

individual historic structures. Even though it was established outside Cairo's walls, Bulaq is an integral part of Old Cairo.

The map of 1820 shows the core of Bulaq as a triangular shape bounded by the River Nile and the port on one side, and by tombs and vegetation on the other two sides. The map also shows three main roads linking Bulaq to Cairo: Chemin du Caire (now Sabtiya Street); Sekket Bulaq (now Shanan Street), and nouveau Chemin du Caire (now 26th of July Street) (Figure 2A).

During the first decades of the nineteenth century, which coincided with Egypt's modernization project, Bulaq became a hub for industrialization and the concentration of technical schools (Marsot, 1984). In this period, Bulaq housed several industrial buildings including textile factories, numerous warehouses, the Bulaq Press, and technical and higher schools (Raymond, 2001). However, with the construction of the modern '*à la Parisienne*' district in the late-nineteenth century, the old city was left to decay (Raymond, 2001). The Cairo map of 1897 by the Ministry of Public Works (Figure 2B) shows the impacts of Cairo's modernization on Bulaq. The Al-Ismailia Canal was dug in 1860 to bring necessary water to Suez Canal cities and the Imbaba railway bridge was constructed in 1889, linking the railway lines of Upper and Lower Egypt and linking Bulaq with Imbaba on the opposite bank of the Nile.

The general map of Cairo, by the Egyptian Survey Department (1920–21) (Figure 2C) shows the rapidly sprawling urban mass of Bulaq in the early twentieth century. It shows the drying-out of Al-Ismailia Canal, the railway and tramway networks covering wide parts of Bulaq, and the construction of the Bulaq Bridge, one of the earliest metal bridges in the country. It is important to note that, during the 1930s, a complete re-planning proposal for Bulaq was drafted adopting western planning standards. The proposal considered retaining only historic mosques and churches while completely wiping out the historic urban fabric (Volait, 2001). This plan was never implemented. However, during the 1940s, a breakthrough street (Bulaq AlGadid

Street) was implemented, leaving a clear cut through the historic fabric of Bulaq (Figure 2D).

During the second half of the twentieth century, Egypt underwent a series of major events including the Cairo fire (1952), the July Revolution (1952), and three wars (1956, 1967 and 1973). In this period Egypt shifted between two contrasting economic and political paradigms: Socialist with President Nasser, and the Open-Door Policy with President Sadat. This had clear impacts on Bulaq given that several replanning schemes with different approaches were projected under the two contrasting ideologies (Selim, 2016). Some of the major physical changes that took place in Bulaq in these decades can be traced in The Egyptian Survey Department map of 1980 (Figure 2E). Changes started with the construction of Cornice Road that was lined with a number of institutional buildings, along with the planning of several clearance, demolition and social housing relocation schemes for Bulaq's dilapidated parts, which stopped due to the 1956 and 1967 wars (Selim, 2014). Then, with the open-door policy adopted during the 1970s, drastic changes occurred to Bulaq. The strip alongside the Nile underwent major demolition and transformation into high-rise private leisure facilities, tourist hotels and office buildings, separating the historic urban body of Bulaq from the river front; some areas were cleared and the tramway tracks were gradually dismantled (Selim, 2015).

Finally, the recent Google Earth satellite image shows an accumulation of dramatic changes that took place from the 1980s to the present. The number of multi-storey buildings along the riverfront soared; the October Bridge was constructed; the Bulaq Bridge was dismantled and replaced with the 26th of July flyover, and Maspero Triangle was demolished for a mixed-used development project (Figure 2F).

This morphological analysis shows that the current protection boundaries of Bulaq include only the oldest part of the urban fabric that was developed pre-1800. Bulaq, however, has evolved and accumulated other significant



Figure 2. Morphological transformation of Bulaq (1820–2020).

layers of history since the 1800s. The following section investigates a local urban area within Bulaq that fulfills the previously mentioned selection criteria and is indicated in Figure 2. By using the morphological regionalization process, the study tests whether significant urban fabric could still be found in the selected local area of study.

Morphological regionalization of the local area of study

This section presents a plot-by-plot survey of the selected local area of study. The area is a historic part of Bulaq extending to around 73,600 m². Its urban fabric shows early phases of modern planning that started to develop in the late-nineteenth century (Figures 2B, 2C). In contrast to the adjacent protected area with its traditional organic urban fabric, the local area includes orthogonal streets of different widths and plots sizes. The survey comprises the three basic form complexes: plan units, building types/forms and land-use surveys. This triad is then overlaid and synthesized into the morphological regions map (Figure 3).

The plan-unit survey (Figure 3A) demonstrates a two-tier hierarchy of units, and hence two orders of boundaries. First-order boundaries are shown as continuous thick lines, and comprise plots and streets laid out pre-1920, while second-order boundaries are shown with dashed lines, and comprise plots and streets laid out between 1920 and 1948. Each of the two order boundaries include zones that vary in terms of homogeneity of plots, blocks and street patterns. The two order boundaries and their varying units can be described as follows.

First-order boundaries comprise three plan units (1.1, 1.2 and 1.3), located on the eastern and western sides of Wabur al-Faransawy Street (Figure 3A). They mostly follow the orthogonal street grid, with discrepancies in plot and block sizes, and with varied street widths and frequencies. While unit 1.1 includes the largest plots and block sizes, the widest streets and higher streets frequencies, unit 1.2 includes intermediate plots and block

sizes, with average streets widths and frequencies, and unit 1.3 includes the smallest plots and block sizes with the narrowest streets and lower frequencies (Table 2).

Second-order boundaries comprise five plan units (2.1, 2.2, 2.3, 2.4 and 2.5). All are located on the eastern side of Wabur al-Faransawy Street (Figure 3A). Like the areas within the first-order boundaries, the orthogonal street grid is also followed and various sizes of plots and blocks, and varied street widths and street frequency are detected. Zones 2.1, 2.2 and 2.3, however, include much larger average plots sizes than those in the first-order boundary zones. Zones 2.4 and 2.5, on the other hand, have similarities in terms of plots, and block sizes and street widths and frequencies with zones 1.2 and 1.3 respectively (Table 2).

The building types/forms survey (Figure 3B) shows several types of building forms dating back mainly to three morphological periods: the traditional, the intermediate and the contemporary. The traditional period units include (a) a traditional houses unit: traditional houses on small-sized plots (average 80 m²), with a height of 3–4 storeys, comprising one flat on each floor and of load-bearing wall construction, with classical features on the façades (Figures 3B, 4A); (b) a traditional apartment buildings unit: apartment buildings on large-sized plots (average 450 m²), of 4–5 storeys, comprising several flats on the same floor, also with classical features on the façades (Figures 3B, 4B); (c) an industrial and workshops unit: one-story industrial buildings characterized with wide spans and metallic or wooden truss covering (Figures 3B, 4C); (d) a religious building unit comprising the Lady of Mount Carmel church: a historic church built in 1929, of Romanesque style. The church is registered as a significant building of value by NOUH (Figures 3B, 4D); and (e) a modern apartment buildings unit: multi-story apartment buildings that are – like the traditional apartment buildings – built on large-size land lots (average 450 m²) and of 4–7 storeys, and they illustrate a variety of modern styles, from Art Deco to Art Nouveau (Figures 3B, 4E).

The intermediate period units include (a) a schools unit, including the two schools of

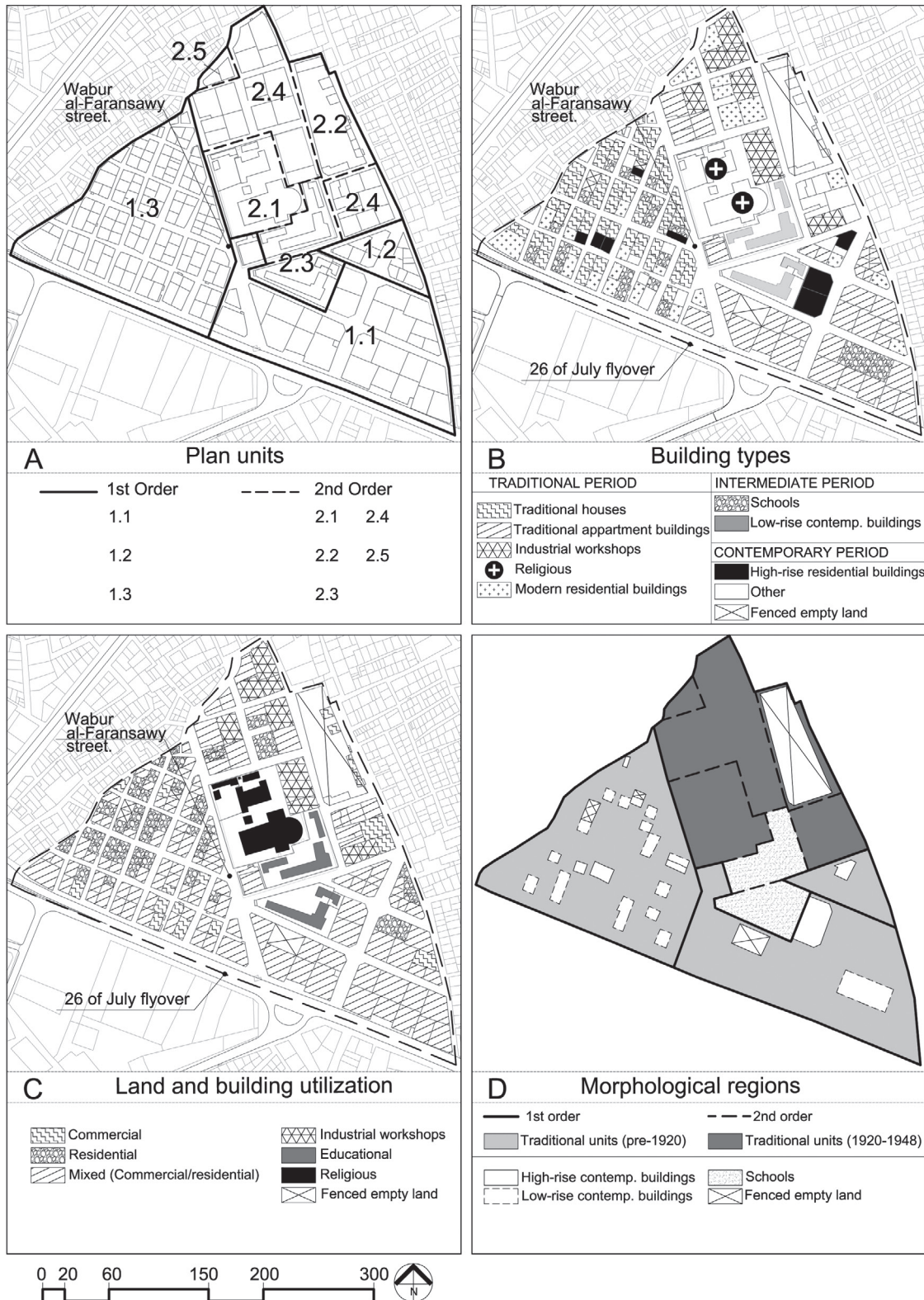


Figure 3. Form complexes in the selected local area of study.

Table 2 Plan unit analysis in the local area of study

	1st order: Pre 1920			2nd order: 1920–48				
	1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5
Location from Wabur al-faransawy St	Eastern side	Eastern side	Western side	Eastern side	Eastern side	Eastern side	Eastern side	Eastern side
Av. plot size (m ²)	450	350	80	5700	4500	2300	350	160
Av. difference		100	270		1163	2227	1950	190
Av. block size (m ²)	Large 3300	Medium 850	Small 320	E. Large 5700	E. Large 4500	Large 2300	Medium 1700	Small 350
Av. difference		2450	530		1200	2200	600	1350
Av. street widths (m)	12	10	6	–	–	8	8	8
Av. difference		2	4	–	–		0	0
Av. street frequency (m)	50	40	25	–	–	50	50	15
Av. difference		10	15				0	45

Bulaq. Both are characterized by modern design, large building block plan and large inner open space (Figures 3B, 4F); (b) a low-rise residential unit including low-rise residential buildings of 3–4 storeys, built on the old plots, replacing traditional unit buildings (Figures 3B, 4G). Finally, the contemporary period unit includes multi-story residential buildings of 11–13 storeys, built on old plots replacing traditional unit buildings (Figures 3B, 4H).

The land and building utilization data (Figure 3C and Table 3) demonstrate the dominance of mixed use residential-commercial units (32 per cent) located mainly on major streets. The second major use is the residential units (8 per cent), followed by religious use and educational use (7 per cent), then industrial use and empty sites (6 per cent), and finally purely commercial units (4 per cent). Table 3 shows the distribution of different uses in relation to the three main morphological units of building types/forms.

Discussion

While current protection boundaries enclose only the pre-1800 area, the morphological regions map (Figure 3D) showed interesting historic urban fabric comprising traditional pre-1920 units, and traditional units built between the 1920s and late 1940s. These

units represent early forms of modern townscape that stand in contrast with the historic traditional fabric. Both the traditional and the early-modern urban fabric were the product of different circumstances; they belonged to different residents of various social strata, reflecting the richness of Bulaq and representing a physical manifestation of different layers of history. It is therefore contended that the protection boundaries should enclose areas that show this rich urban variety to demonstrate Bulaq's multi-layered history. Figure 2F showed that several historical areas, located outside the protection boundaries, were cleared for modern development projects. This began with the river-front strip in the 1980s and concluded with the most recent demolition of the Maspero triangle in 2018. With both cases, the area lost important historic fabric and parts of the rich urban pattern of Bulaq.

Several studies have discussed the stability and resilience to change of the three fundamental elements defining urban form: buildings; plots; and streets (M. R. G. Conzen, 1960, 2004; Moudon, 1986). While buildings can be subject to fast demolition and reconstruction, plot patterns are relatively more enduring but are prone to change over time by being subdivided or amalgamated, and street patterns represent the most enduring elements. Changes do happen to streets patterns, however, in cases of war or major urban









<p>A</p> 	<ul style="list-style-type: none"> - Traditional houses, - Ground+2/3 fl., - Classical features at the facades, - One flat at each fl. - Small plot sizes. 	<p>B</p> 	<ul style="list-style-type: none"> - Traditional apartment buildings. - Ground+3/4 fl., - Classical features at the facades, - Several flats at each fl. - Large plot sizes.
<p>C</p> 	<ul style="list-style-type: none"> - Industrial buildings, - One story height, - Wide spans, - Metallic truss, covering. 	<p>D</p> 	<ul style="list-style-type: none"> - The Lady of Mount Carmel Church, - Romanesque Style, - Listed as a significant building of value (NOUH).
<p>E</p> 	<ul style="list-style-type: none"> - Modern apartment buildings, - Ground+ 3/6 fl. - modern features at the facades (art-deco or art-nouveau - Several flats at each fl. - Large plot sizes. 	<p>F</p> 	<ul style="list-style-type: none"> - Schools - Modern architecture, - Large building block plan, - Large inner open space.
<p>G</p> 	<ul style="list-style-type: none"> - Low-rise contemporary residential buildings, - Ground+ 2/3 fl. 	<p>H</p> 	<ul style="list-style-type: none"> - High-rise contemporary residential buildings, - Ground+ 10/12 fl.

Figure 4. Characteristics of building types in the selected local area of study.

Table 3 Land and building utilization

Type of use	Area (m ²)	Per cent (of total area)	Traditional period units	Intermediate period units	Contemporary period units
Mixed use	23,795	32	P	P	P
Residential	5798	8	P	P	P
Religious	5230	7	P	O	O
Educational	4935	7	O	P	O
Fenced empty lands	4262	6	P	O	O
Industrial	4100	6	P	O	O
Commercial	2580	4	P	O	O
Streets/open spaces	22,900	30	P	O	O
TOTAL	73,600	100			

developments which require comprehensive transformation. By tracing the development of a selected local area throughout the period of morphological transformation of Bulaq's macro-scale context over 200 years (Figure 2), it is evident that the area maintained its street patterns and its building blocks. However, the overlaying of the three maps in the morphological region map (Figure 3D) shows threatening transformations on the level of building types, producing a significant source of deviation from the homogeneity of the historic area. Transformation is mainly the product of low-rise or high-rise building replacement on individual historic plots. Since the selected local area of study is not registered within the protected area of value by NOUH, new buildings do not need to follow particular regulations in order to fit the character of their historical surroundings. These changes have mainly occurred within first-order units built before 1920 and thereby threaten their character.

Conclusion

The delimitation of protection boundaries for areas of value is amongst the most important early steps in maintaining urban character. However, the methodologies to follow in pursuit of establishing well-defined boundaries still face challenges. This paper supports applications of urban regionalization to inform the process of protection boundary delimitations.

Through morphological analysis of archival materials and historic maps of Bulaq from 1820 to 2020, together with a morphological regionalization of a selected local area of study, this paper has pinpointed a gap in the process of delimiting local protection boundaries in Egypt. Currently only pre-1800s Bulaq is encompassed within the protection boundaries. However, important historic townscapes in the selected local area of study that are not included within current protection boundaries were revealed.

For the area of study, street patterns, plots sizes and shapes have been maintained since the last decades of the nineteenth century. Individual buildings, however, are being rapidly replaced with new constructions that disturb the local character of the historical area. Since the area of study is not registered as a protection area, no special regulations apply for new construction. This leads to rapid change in building types and hence a gradual loss in the urban value of the area. This calls for revisiting current local protection boundaries of the historic quarter, as well as a revision of the adopted local processes of protection boundary delimitation in general.

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