Understanding the links between inherited built forms and urban design: Athens and Alexandria as case studies

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Abstract. *This comparative study of three historical layers of the urban form of Athens in Greece and Alexandria in Egypt focuses on the links between heritage and the design of the public realm (street networks, public open spaces, and civic structures). The approach combines Geographical Information Systems, elements of town-plan analysis, and historical archival research. The aim is to improve understanding of the impact of heritage on the design of the public realm and how this can inform future urban design. The analysis reveals that during major periods of their history, Athens and Alexandria shaped their public realms through combining elements of their urban heritage, street network design, and the innovative design of civic structures.*

Key Words: historical urban morphology, urban design, spatial technology, Athens, Alexandria

This paper addresses the links between urban morphology and urban design. It confines attention to the public realm (notably street networks, public open spaces, and civic structures). A method is developed for the comparative study of the design of the public realms of Athens in Greece and Alexandria in Egypt. The approach combines Geographical Information Systems (GIS), with aspects of town-plan analysis, and historical archival research. Particular attention is given to the links between heritage and the design of the public realm.

Two questions pertinent to the current methodology of urban morphology are addressed: first, how can a combination of GIS, town-plan analysis, and historical archival research contribute to understanding the role of heritage in the design of the public realm; and secondly, how can such understanding inform present and future urban design? Three historical 'layers' of the urban form of Athens and Alexandria are compared for periods when the two cities underwent similar major urban design projects to reconfigure their public realms and, in particular, their street networks. The periods are the classical period, the nineteenth century and the twenty-first century. The analysis reveals that in each of these periods Athens and Alexandria shaped their public realms through urban design that combined elements of their urban heritage, street network design, and design of civic architecture. The significance of this type of research stems from its contribution to efforts to build bridges between the Conzenian morphological tradition and urban design.

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Previous research

In the analysis of historical urban form, a number of researchers have used metrological analysis and town-plan analysis (Lilley *et al*., 2005; Lo, 2007; Whitehand, 2001). Metrological analysis depends significantly on field surveys to reconstruct historical town plans (Lilley *et al*., 2005), while town-plan analysis investigates the 'topographical arrangement of an urban built-up area in all its man-made features' (Conzen, 1960, pp. 4-5). Town-plan analysis is concerned with streets and their organization into street-systems, plots and their arrangement in street-blocks, and buildings and their footprints or block-plans (Conzen, 1960). Developed by Conzen in his studies of English medieval towns, the method gives particular attention to inferring historical developments of urban form from more recent plans and field observations. For example, eighteenth- and nineteenth-century plans were used by Conzen to help detect medieval and post-medieval developments of streets, plots and building footprints (Conzen, 1960).

Building to some extent on Conzen's town-plan analysis, spatial technologies have been used to analyse historical urban form (Koster, 1998; Lo. 2007). The beginnings of the use of information technology in the study of urban morphology go back to the University of Pisa's innovative combination of town-plan analysis and Computer Aided Design (CAD) applications in their study of Capri, Italy. Later research in England and in continental Europe combined computerized technologies with early cadastral plans – these provide the earliest accurate representations of plot boundaries (Koster, 1998). Many of these early approaches derived historical plot patterns, considering them the smallest and most fundamental units for the analysis of the development of urban form (Conzen, 1960; Whitehand, 1990, 2001). Once plot patterns were derived, it became possible to incorporate computerized and other techniques, such as GIS and image processing, in place of conventional metrological analyses (Koster, 1998). The innovativeness of Koster's study of historical Groningen in the Netherlands lies in how it utilized historical registers of plot sales to obtain data about plot sizes during the seventeenth century. The integration of these data into GIS software linked plot sizes to their probable location on the map, thus enabling researchers to construct a map of the plot patterns of the seventeenth-century town (Koster, 1998, pp. 4-6). Computerized reconstructions also allowed inferences to be drawn about the location of city gates and their influence on Groningen's street pattern (Koster, 1998, p. 7).

More recently, Lilley *et al*. combined Global Positioning System (GPS) and GIS technologies in their study of the medieval built form of Winchelsea in England. They used GPS to survey and map the visible historical remains and provided very accurate data to complement previous metrological analysis. Once GPS data were incorporated in ArcGIS, the team was able to reconstruct the town and generate three-dimensional morphological analyses (Lilley *et al*., 2005).

Where historical remains are unexcavated or no longer exist, the use of GPS becomes impracticable. In these circumstances the digitization of historical town plans can be used to compare old and new plans (Lo, 2007). This is the case in the research project described here: the digitization of historical maps of Athens and Alexandria facilitates quantitative analysis through GIS in place of a traditional metrological approach. In particular, the topological function 'allows GIS to conduct network analysis and overlay, which are the most useful functions of GIS. Network analysis allows connectivity between features to be identified and when applied to a town plan will reveal how planners design the street patterns' (Lo, 2007, p. 87). The design of street patterns is what this paper sets out to analyse, especially its relationship to elements of urban heritage and civic structures.

The approach

The application of information technology to the Conzenian approach gives priority to the gradual evolution of historical urban forms.

This paper attempts instead to use information technology to link an essentially Conzenian perspective to urban design. 'Urban design' refers here to one-off initiatives to reconfigure urban form through a specific design agenda that is implemented within a relatively limited time period. It is concerned with the public realm, the major components of which are streets and street systems, public open spaces (for example, plazas and waterfronts) and civic structures (Carmona *et al*., 2003; Moughtin and Mertens, 2006; Rowe, 1997). The focus is on the links between street network, public open spaces, and landmarks. In the course of time these become heritage, whether as tangible elements in the city or as part of collective memory. The building footprints and plot patterns of the private realm are not considered in this particular study.

Athens and Alexandria

Athens and Alexandria, along with Rome, were among the most prominent academic centres during classical times. Owing in part to their geographical proximity within the Mediterranean basin, Athens and Alexandria had much in common (Pollard and Reid, 2006; Vrettos, 2001). Most importantly, their urban form was similarly affected by major urban design initiatives at similar periods in history.

Between the fourth and first centuries BC, the first urban layer of each city evolved, and as their urban forms matured between the second and third centuries AD, both cities became world famous, Athens for its *genius loci* and Alexandria as a cosmopolitan academic centre. Their civic structures, such as the Acropolis of Athens and the Pharos and Bibliotheca of Alexandria, became urban landmarks that drew tourists from all over the ancient world. There is evidence that as early as the classical era, tourists were aided by guidebooks, such as Callixeinus the Rhodian's book *On Alexandria* (Foertmeyer, 1989).

The first half of the nineteenth century was a turning point in the history of both cities: they were regenerated after centuries of insignificance and decline during which the population of each diminished to less than 5000 inhabitants. Once they were liberated from Ottoman subjugation at the onset of the nineteenth century, however, grandiose urban design plans were put forward for both cities. By the middle of the nineteenth century, each city had acquired a new street layout, complete with new public open spaces and an array of civic structures. By the beginning of the twenty-first century both cities were attempting to reconfigure their central street networks, employing major urban design initiatives. These initiatives, continuing today, seek to overcome problems stemming from rapid urban growth during the twentieth century.

The multi-layered comparison that comprises the remainder of this paper is concerned with how urban design initiatives have incorporated inherited elements of the urban landscape in an attempt to preserve the *genius loci* of each city (Samuels, 1990, 2009; Whitehand, 1990, pp. 371-2; Whitehand, 2009). This notion parallels the Conzenian concern for the way in which the past can become inspirational for the future (Whitehand, 1990). The paper identifies various urban design elements that articulate each city's tangible or intangible heritage within the public realm.

Methodology

According to Lo (2007, p. 87), 'if old town plans can be digitized, comparison between old and new plans can be easily achieved and some form of quantitative analysis is possible (as in the metrological approach)'. The proposed methodology of combining GIS technology, historical and contemporary maps, and street system analysis accords with this. Other secondary sources, such as historical archives and contemporary publications augmented the analysis by shedding light on the perception of heritage in each city during the selected periods of comparison.

Reconstruction of the street pattern of the classical period and the nineteenth century was achieved by scanning historical maps. The

classical and nineteenth-century maps of Athens were obtained from Travlos (1993, p. ΠΙΝ.ΙΙΙ and p. 255 ff.). Alexandria's classical map was obtained from Kiepert (1903, Tabelle III) and its nineteenth-century one from Forster (1961, pp. 1-2). These maps were then georeferenced in ArcGIS. Georeferencing refers to 'the process of registering a geographic data set to an accepted coordinate system' (Lo and Yeung, 2002, p. 464). It was achieved in this research project by determining the coordinates of certain points on each of the historical maps by selecting a known point of reference, such as the corners of historical structures (Lo and Yeung, p. 464). The street systems of the classical era were then created in line format based on the georeferenced historical maps. In the case of the nineteenth century, the scanned maps were compared with the contemporary street network to detect the differences between them. All contemporary streets that did not exist in the nineteenth-century maps were then removed, while streets that existed only in the nineteenth-century maps were added. Polygons were then created to demarcate the boundaries of the classical and nineteenth-century cities. This facilitated the calculation of total areas.

In both cases, street lines were divided into segments according to their intersection nodes, creating topological relationships. Each line was broken whenever it intersected or touched another line. This process cleaned the polygon layers in the digitized maps from sliver polygons, also known as spurious polygons, which result from errors in data acquisition. The process also cleaned the line layers from overshoots and undershoots, which are topological errors that result when arcs extend beyond their intended intersection, or when they do not extend to their intended intersection (Lo and Yeung, 2002). The resulting street network was then set to an Equidistant Azimuthal projection, which preserves distances more accurately than other projections (Gott III *et al*., 2007; Lo and Yeung, 2002). Quantitative analysis was then carried out, including of street segment lengths, which were then measured by creating tabular data and adding them to the street files. The attribute files were then used to identify the shortest and longest streets by ordering their ascending/descending records. Finally, total and average segment lengths, numbers of street segments, and the total area of each city were calculated.

The advantages of using GIS in the study of historical urban forms stem from their ability to combine a variety of data sets, such as maps and aerial photographs, in one interface. This combination facilitates the reconstruction and analysis of urban form at a particular point in time. Moreover, GIS techniques generate an array of quantitative outputs that can be used to augment the analysis (Lilley *et al*., 2005; Lo, 2007; Moudon, 1997, p. 9).

The following sections link the aforementioned methodology to qualitative information from historical and contemporary sources. The ensuing approach reveals how combinations of elements of urban heritage, street network design, and innovative designs of civic structures have been used to shape the public realm of Athens and Alexandria during each of the three periods.

The classical period

Different concepts influenced the initial layout of the street networks of classical Athens and Alexandria. Whereas the former had a mythological foundation, the latter had a purely functional one (Meier, 1998; Pollard and Reid, 2006). GIS analysis confirms how these conceptual differences manifest themselves spatially. Since both Athens and Alexandria were walled during the classical era, it is possible to compare their total areas. These differed significantly, Alexandria's area being more than seven times that of Athens. Alexandria had a more elaborate street network, as is evident in the larger number of street segments and their greater total length. The latter was nearly double that of Athens (Table 1).

Notwithstanding the differences between their initial foundation concepts, the two cities shared a similar approach to the design of their

Table 1. Street-network and area analysis of classical Athens and Alexandria

Unit of analysis	Athens	Alexandria
Total area (square metres)	902 000	7 307 000
Number of street segments	99	301
Sum of length of all street segments (metres)	12 610	66 608
Average length of street segments (metres)	127	221
Shortest street segment (metres)	5	14
Longest street segment (metres)	460	1 859

public realm, namely a street network that was dominated by one or two main streets and civic buildings with innovative designs that later acquired symbolic significance (Figures 1 and 2). Table 2 summarizes these urban design approaches.

In Athens, an array of public open spaces and civic structures included the Agora and the Acropolis, as well as the Olympieion, Odeion, Theatre, and Hephaestium. The Panathenaic Way played a major role in the Panathanaean procession, which was Athens's most important religious event and allowed participants to experience all the public open spaces and civic structures. The Panathenaic Way highlighted the hierarchy within the public realm, particularly the visual and functional dominance of the Acropolis (Harrison, 1976; Meier, 1998, p. 381; Tung, 2001). It reflects the essence of Athens's symbolic status, especially the intricate relationship between Athenian religious, political and social life (Rossi, 1984. p. 136).

Alexandria's street network, laid out by Dinocratis as a gridiron, followed the functional properties of Hippodamus of Miletus, particularly the representation of civic life and the divisions of labour and income (Pollard and Reid, 2006, pp. 24-5). The street network also highlighted Alexandria's relationship to the Mediterranean, particularly the two axes of the grid running parallel and perpendicular to the Mediterranean (Abdel-Salam, 1995; Vrettos, 2001). Like Athens, Alexandria had public spaces and civic structures that were unprecedented. These included the Heptastadion (the bridge that connected the city to the Pharos Island), Bibliotheca, Mouseion, Soma (Alexander's Mausoleum), Serapium and Pharos. These structures were laid out in relation to the street network, particularly in relation to two main streets that dominated each axis of the grid and formed the main colonnaded avenues: the east-west Canopic Way and the north-south Street of the Soma. Like the Panathenaic Way in Athens, these avenues connected the city's formal gates and, together with the north-south Selatic Way, also linked Alexandria's important civic buildings and structures, such as the Bibliotheca, Serapeum, Heptastadium and Pharos. Most importantly, through these unprecedented civic spaces and structures, Ptolemy and his descendants fused Greek and Pharaonic cultural elements in an attempt to use urban design to legitimize their rule over Egypt (Pollard and Reid, 2006; Vrettos, 2001). Along with the Bibliotheca, this eventually bestowed on Alexandria a cosmopolitan and academic status.

The nineteenth century

During the Ottoman rule, which lasted from the middle of the fifteenth century until the end of the eighteenth century, both cities were reduced to a single urban quarter (Bastéa, 2000; Reimer, 1988, 1993). In the first half of

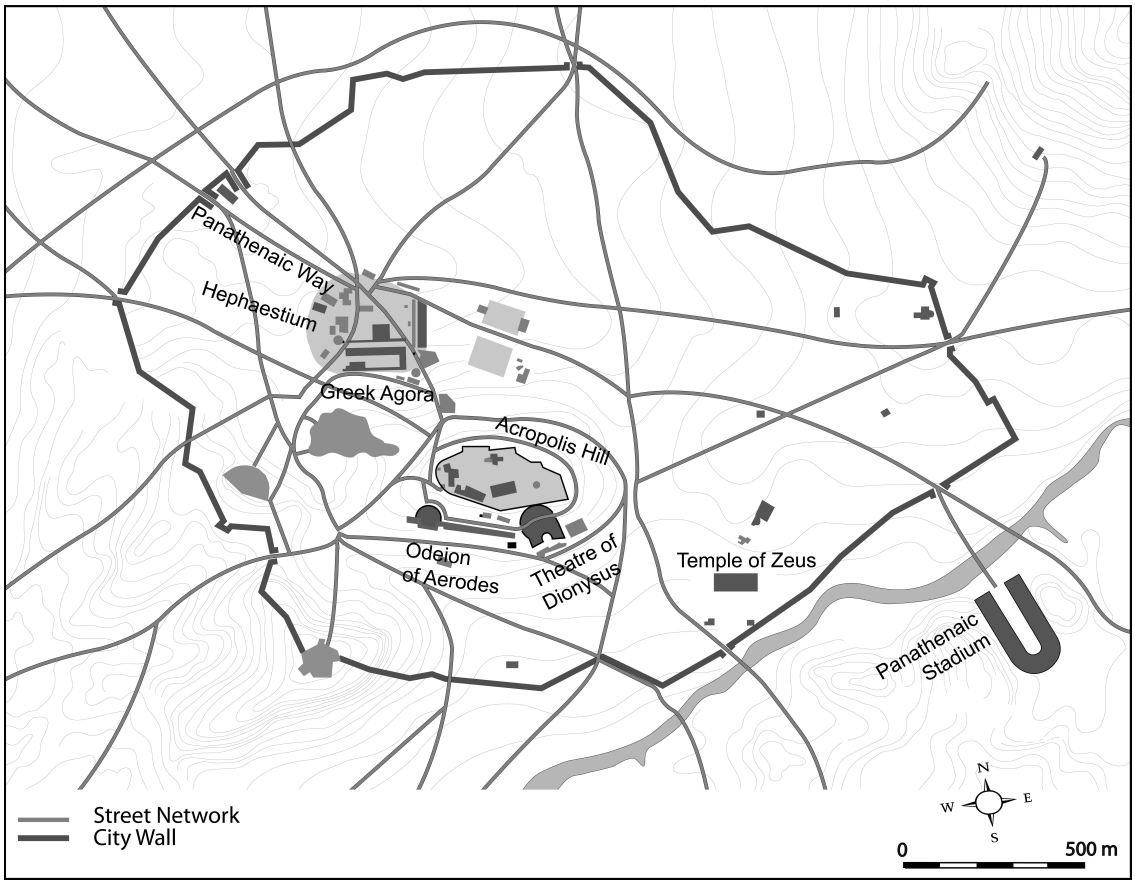

Figure 1. Classical Athens (based on Travlos, 1993, p. ΠΙΝ.ΙΙΙ).

Table 2. Summary of the shaping of the urban space of Athens and Alexandria during the classical era

	Athens	**Alexandria**
Street network	Organic mythical layout	Functional geometric gridiron
Innovative civic designs	Include, but not limited to, the Agora, Acropolis, and Stadium	Include, but not limited to, the Pharos, Bibliotheca, Soma, Serapeum, Museon
Main street	The Panathenaic Way: a) connects civic structures and spaces, and leads to the Acropolis; b) incorporates hierarchy, and harmony with the natural setting	The Canopic Way and Street of the Soma, Selatic Way: a) connect civic structures and spaces, and lead to the Pharos; b) link Alexandria to the Mediterranean
Heritage	Athens as *genius loci*	Alexandria as cosmopolitan (fuses two cultures) and academic centre

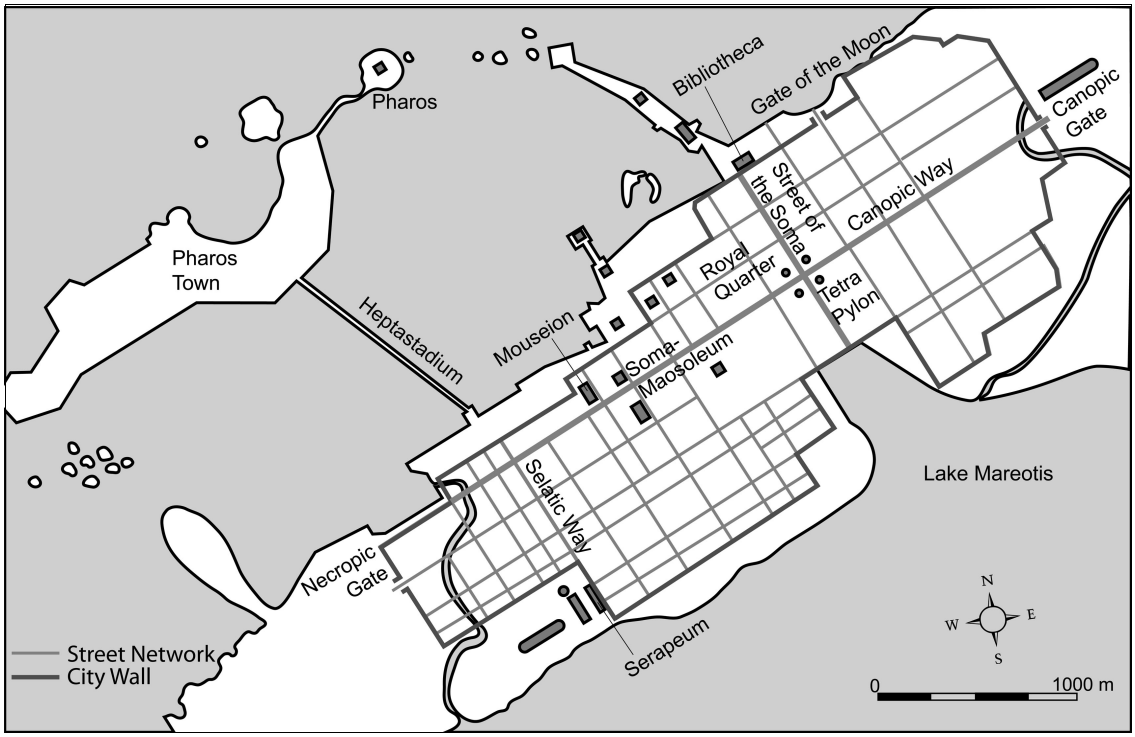

Figure 2. Classical Alexandria (based on Kiepert, 1903, Tabelle III).

the nineteenth century, however, exposure to West European influences led to a transformation. France, Britain and Germany had supported Greek independence from Ottoman rule, and once Athens was declared capital of Greece in 1834, they established the Bavarian Prince Otto on Greece's throne (Bastéa, 2000; Roberts, 1996). The Western powers also placed Athens's classical heritage at the centre of a European collective past and as the focus of Greek national pride (Bastéa, 2000; Boyer, 1994; Faubion, 1993; Leontis, 1995). These notions were to receive morphological expression with the announcement of a design competition for a new Athens. This was won by a German-Greek team. The Schaubert-Kleanthes plan's most innovative idea was its designation of the first urban archaeological park in the world. This celebrated Athens's classical heritage and brought it into the lives of ordinary Athenians (Bastéa, 1994, 2000; Faubion, 1993; Tung, 2001).

At the same time, Egypt's Ottoman Viceroy, Mohamed Ali declared independence from the Ottoman Empire in the wake of Napoleon's expedition to Alexandria in 1798, and proclaimed himself king. Aware of the economic opportunities brought about by Europeans, Mohamed Ali encouraged them to move to Alexandria and offered them concessions such as land ownership and tax exemptions (Reimer, 1988, 1993). As a result of Mohamed Ali's policies and Napoleon's expedition, Alexandria became a major Mediterranean port and the gateway to the Orient (France, 1991; McGregor, 2006; Stevens, 1963). It had an influx of European immigrants who became affluent citizens and helped to recreate its classical cosmopolitan glory (Awad, 1996; France, 1991; Reimer, 1988, 1993). Alexandria's Europeans formed the Conseil de l'Ornato in 1834. This was the first urban planning body not only in Egypt, but also in all the areas that were affiliated to the Ottoman Empire. Its objective was to create a new Alexandria that was part of the world economy (Ilbert, 1997; Reimer, 1993; Starr, 2005).

Two concepts influenced the layouts of the nineteenth-century street networks of Athens

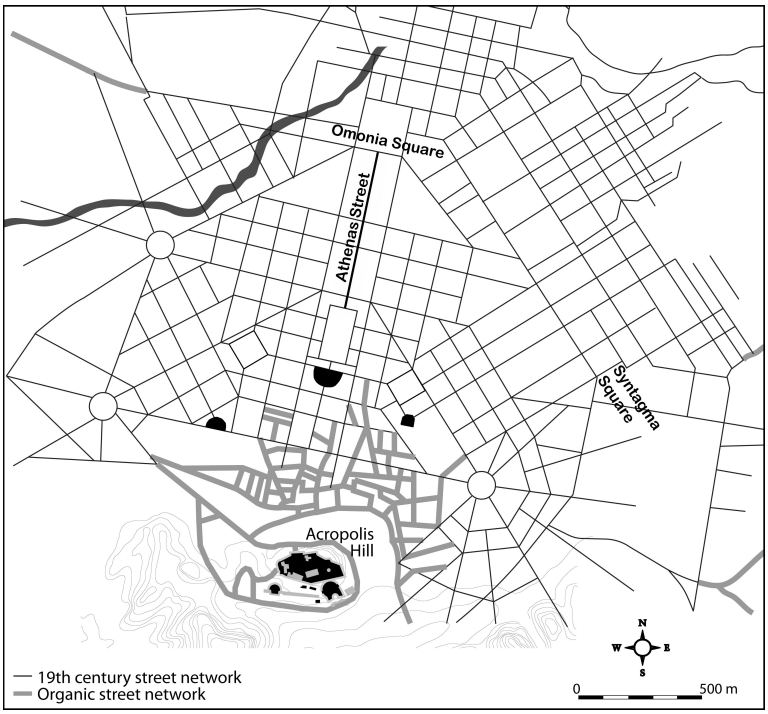

Figure 3. Nineteenth-century Athens (based on Travlos, 1993, p. 225).

and Alexandria: first, West European standards of what was considered *avant-garde* at the time; and secondly, symbolically significant historical associations. The urban forms of the two cities took on many characteristics in common, especially their division into a traditional quarter (the Plaka in Athens and the Gomrok in Alexandria) and a Europeanized one (New Athens and, in Alexandria, the Frankish quarter). Their traditional quarters, the Plaka and the Gomrok, consisted of similarly shaped organic street networks: they lacked public open spaces and their plot sizes were very small. These quarters were also attached to ancient remains: the Plaka covered the slopes of the Acropolis hill, and the Gomrok formed a man-made peninsula over the ancient Heptastadium that linked the mainland and Qayet Bay's Fort.

The Europeanized quarters also shared many similarities in the layout of their new street networks. They were both formed of a regular geometric gridiron, intersected by diagonal boulevards. The diagonal boulevards converged at a single focal point (Omonoia Square in Athens and the Place de Consuls in Alexandria). Public spaces, such as Syntagma Square in Athens and the French Gardens in Alexandria, were placed at the points where the diagonals intersected the regular grid. Moreover, the new street network had strong associations with tangible and intangible elements of urban heritage. The Acropolis Hill became the focal point of New Athens and the Athinas Street extended from the focal point at Omonoia Square to the foot of the Acropolis Hill. Similarly, the Corniche, which became Alexandria's new waterfront road, re-emphasized the city's Mediterranean associations (Figures 3 and 4). Table 3 summarizes the approaches adopted in shaping the public realms of Athens and Alexandria during the nineteenth century.

Statistical analysis also confirms that the new designs of Athens and Alexandria share more similarities at this stage than at any other time in their histories. Although the nineteenth-century cities were not walled, it was possible to capture their approximate total areas by creating a polygon layer in GIS over

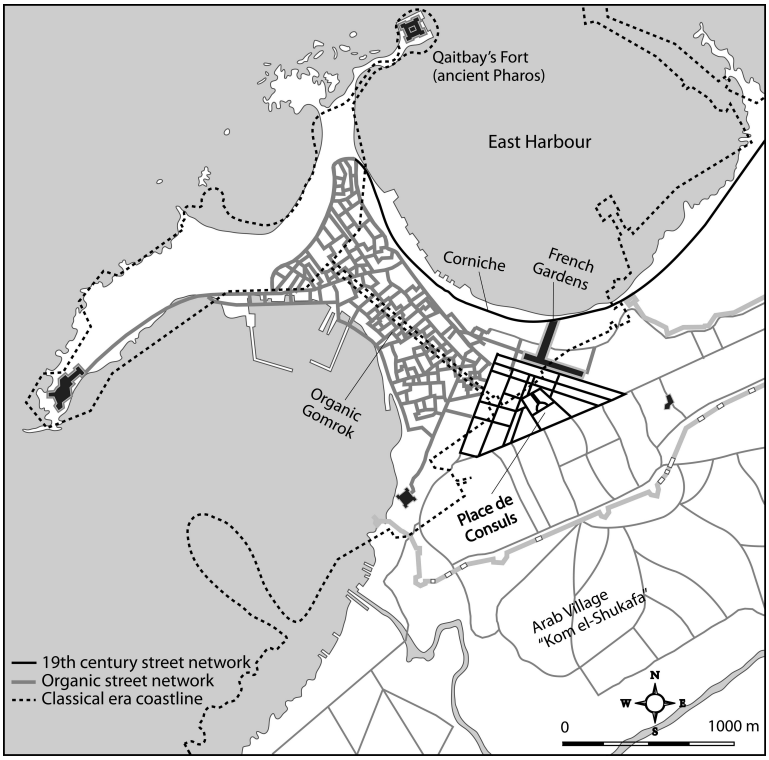

Figure 4. Nineteenth-century Alexandria (based on Forster, 1961, pp. 1-2).

Table 3. Summary of the shaping of the nineteenth-century urban space of Athens and Alexandria

	Athens	**Alexandria**
Street layout	Orthogonal street network that intersects with 45º diagonal boulevards, with public open spaces (plazas and gardens) placed at the point of intersection	
Civic spaces	Omonoia Square	The Place de Consuls
Main street	Athinas Street	The Corniche
Heritage	The Acropolis symbolizes the status of Athens as *genius loci* and the cradle of Western civilization	The Mediterranean and Alexandria's cosmopolitan legacy
Innovativeness in urban design	The archaeological park was the first of its kind	The Conseil de l'Ornato was the first first planning body in Egypt and all regions affiliated to the Ottoman Empire at the time

Table 4. Street network and area analyses of nineteenth-century Athens and Alexandria

Unit of analysis	Athens	Alexandria
Total area (square metres)	2 917 000	4 113 000
Number of street segments	397	415
Average length of street segments (metres)	138	163
Sum of all street segments (metres)	54 878	67 521
Shortest street segment (metres)	10	8
Longest street segment (metres)	1 548	2 491

their nineteenth-century street network. The difference between their areas during this period is far less than during the classical era. Moreover, the total number of street segments is almost identical in both cities, as is the average length of street segments (Table 4).

The twenty-first-century spatial reconfiguration

As the status of Athens and Alexandria became more prominent, each underwent rapid population growth. Their populations exceeded 100 000 by the second half of the nineteenth century (Reimer, 1988, 1993; Tung, 2001). Both cities struggled to cope with the increased demands on their civic spaces and structures associated with the Greek civil war in the case of Athens (Orbaşli, 2000; Tung, 2001) and Egyptian nationalization policies in the case of Alexandria (Ilbert, 1997; Starr, 2005). The selection of Athens for the Olympic Games in 2004 and the anticipated inauguration of Alexandria's new library in 2002 provided both cities with incentives to put forward urban design plans: the Project for the Unification of The Archaeological Sites of Athens and the 2005 Visionary Plan for Alexandria (Beriatos and Gospodini, 2004; Dix, 1985).

Town-plan analysis reveals that the two plans depended on three similar urban elements: the rehabilitation of the diagonal nineteenth-century street network and associated public squares, innovative designs for contemporary civic structures, and a major street for pedestrian movement (Table 5). Additionally, both plans proposed traffic-free zones and city walks (Figures 5 and 6).

The nineteenth-century street networks in both cities underwent urban rehabilitation, as did public open spaces such as the plazas in Athens (Beriatos and Gospodini, 2004) and the French Gardens in Alexandria (Rahman, 1993; Starr, 2005). In both cities new civic structures were constructed, namely the New Acropolis Museum of Athens and the New Library of Alexandria. Although their designs are contemporary, each drew on a rich heritage. For example, the columns and open space of the New Acropolis Museum resemble the Pantheon, while its glass floors incorporate Athens's Byzantine archaeological remains within its structure (Biétry-Rivierre, 2008a; Costanzo, 2009, pp. 25, 29). Furthermore, the design of a gallery to house the Parthenon Marbles, which are currently at the British Museum, puts Athens at the centre of a global debate on cultural restitution and places its heritage at the centre of Greek nationalism. It also serves to re-emphasize the issue of Athens's *genius loci* (Biétry-Rivierre, 2008a, 2008b, 2008c; Davies, 2009; Hope, 2009; Serra 2009). Similarly, the circular form of the New Library of Alexandria and the pond

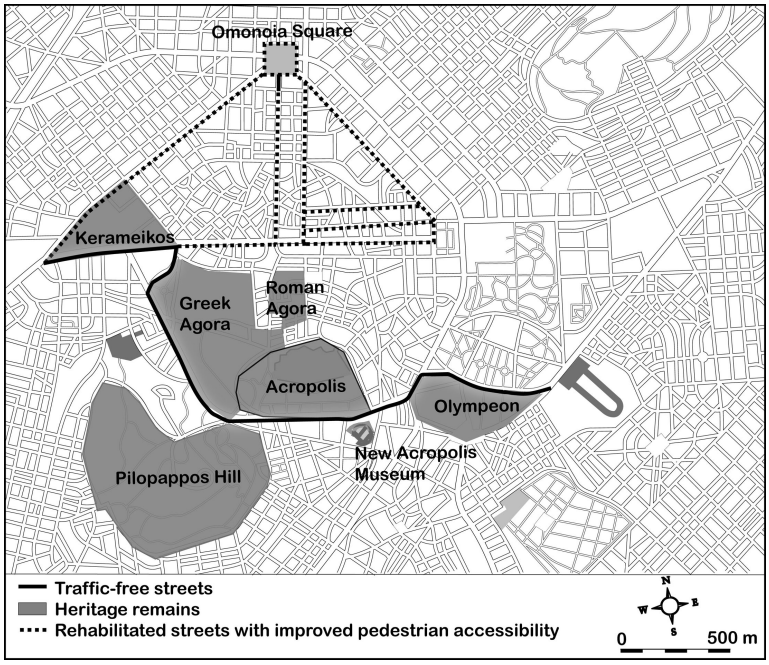

Figure 5. Twenty-first century plans for Athens (adapted from Ενοιηση Αραχαιολογικων Χωρων Αθήνας**, 2008).**

Table 5. Summary of the shaping of the twenty-first century urban space of Athens and Alexandria

	Athens	**Alexandria**
Street layout	Nineteenth-century street network with public open spaces (plazas and gardens).	
Innovative civic design	The New Acropolis Museum	The Bibliotheca Alexandrina
Main street	The Promenade	The Corniche
Heritage	The Acropolis and classical remains	The Mediterranean and the city's cosmopolitan and academic legacies

surrounding it symbolize the Pharaonic sun disc as it emerges from the Mediterranean waters. This is a reference to the Mediterranean's strong influence on the cosmopolitan character of Alexandria. Moreover, the symbolic design evokes the city's cosmopolitan and academic legacies through inscriptions on the circular granite wall that represent all the written languages of the world (Dykers, 2002).

In accord with the Conzenian perspective of integrating inherited forms within contemporary morphology (Conzen, 1981), these new civic structures are linked to the nineteenth-century street network via one major street. The pedestrian promenade in Athens spreads south of the Acropolis and connects six major archaeological sites (Beriatos and Gospodini, 2004), while the Corniche, Alexandria's nineteenth-century

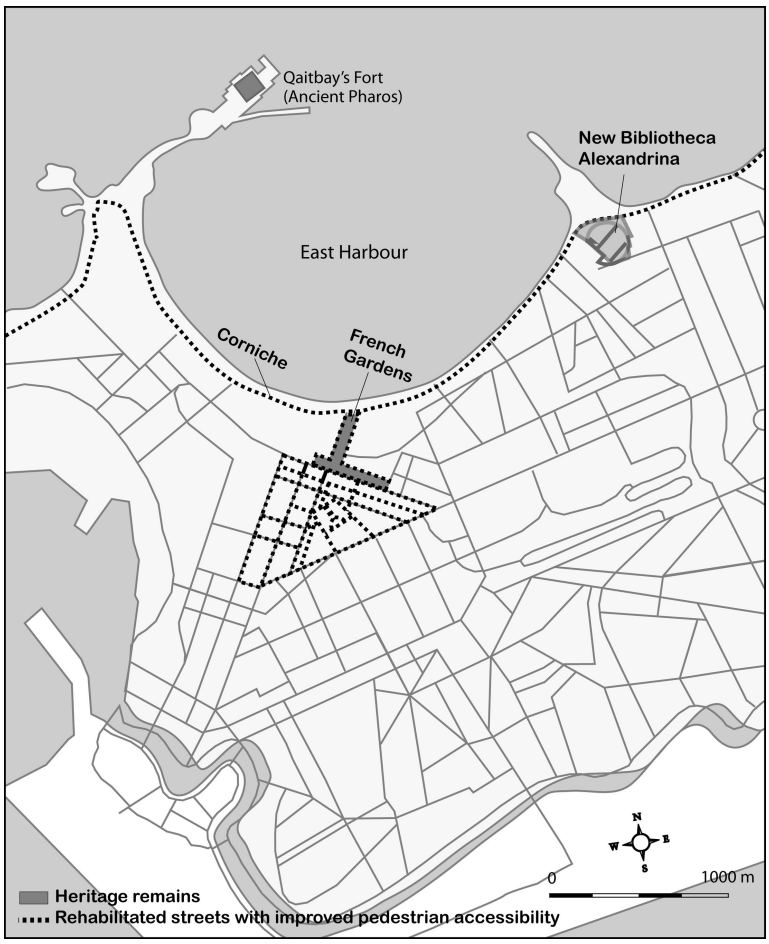

Figure 6. Twenty-first century plans for Alexandria (compiled by the author).

waterfront road, now includes provision for pedestrian activities and links the Bibliotheca to the rest of the city (Starr, 2005). These two historical streets revive Athens's and Alexandria's heritage and incorporate it in its 'rightful place in the daily life of the inhabitants …. and visitors' (Ενοιηση Αραχαιολογικων Χωρων Αθήνας, 2008; Starr, 2005).

Conclusion

This historical comparison reveals how contemporary urban design may incorporate or disregard inherited street patterns (Conzen, 1981; McQuillan, 1990; Whitehand, 1990). When incorporating inherited elements of the urban landscape, contemporary urban design holds the potential to foster a collective identity through a collective experience of urban space (McQuillan, 1990). This is especially evident in the two cities' current attempts at reinventing their urban identities by reverting to their nineteenth-century street networks and by emphasizing their classical identities. The objectives of contemporary urban design initiatives are similar to those of urban design initiatives of the nineteenth century and the classical era, namely to highlight the cities' cultural heritages and to incorporate them in the daily experiences of citizens.

This paper compares the different historical layers of Athens and Alexandria to investigate the influence of heritage on the design of their public realms. In doing so, it investigates the view that contemporary urban design draws

inspiration from inherited urban elements. At the same time the paper explores the potential of combining GIS, town-plan analysis and historical maps to suggest the various urban design elements that articulate cities' heritage within the public realm.

It is suggested that contemporary urban design can benefit from incorporating Conzenian thinking in the design of the public realm. The historical comparative analysis demonstrates that as the two cities strove to redefine themselves they adopted similar combinations of heritage elements and innovative designs of contemporary civic structures and spaces, and developed one or two main streets linking the historical and the contemporary within their new street networks.

The eclectic methodology is a modest step in addressing calls to incorporate Conzenian theoretical and methodological approaches specifically for articulating and planning the public realm (Moudon, 1997, p. 9; Whitehand, 2001). While the analysis focuses on street systems at this stage, the hybrid methodology and the comparative analytical approach facilitate an understanding of historical developments in the design of the public realms of two major cities and the interactions between heritage, contemporary designs, and street networks.

The research described here is concerned largely with two-dimensional analysis, giving particular attention to street systems. Future research on these cities needs to give greater consideration to the full range of aspects of Conzenian town-plan analysis, including plot patterns and the block-plans of buildings. It also needs to incorporate more fully the three-dimensional aspects of urban form. Historical plot boundaries and building footprints are difficult to establish or infer over the lengthy time spans dealt with here, but work to this end is continuing at least for small areas. More research on these aspects is needed if links are to be established between urban design initiatives and plots and building footprints, including the evolution of design initiatives after their implementation.

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Portuguese Network of Urban Morphology

The Portuguese Network of Urban Morphology (PNUM) is the third national/regional network of ISUF to be created. It complements the Nordic Network of Urban Morphology and ISUF Italia. An initial exploratory meeting held in Oporto in September 2009 established the basis for the creation of PNUM: the involvement of different disciplinary approaches, the representation of the main Portuguese universities, the participation of different generations of researchers, and the establishment of a first collaborative research project.

In May 2010, a meeting of fourteen researchers took place in parallel with the CITTA conference on 'Bringing city form back into planning'. It involved brief presentations on the current work of each researcher and a discussion of the first draft of PNUM's Constitution. At the ISUF conference in Hamburg in August 2010 the final version of the Constitution was approved by the Council of ISUF. The Scientific Council of PNUM is Vítor Oliveira (President), Teresa Marat-Mendes, Paulo Pinho, Mário Fernandes and Jorge Correia. It held its first meeting in September 2010.

The principal goals of PNUM are three: first, to promote the study of urban form; secondly, to develop a Portuguese network in the field of urban morphology, through the organization of meetings, the publication of a newsletter, and the development of joint applications for national funding; thirdly, to build a strong relationship with ISUF, through collaboration on ISUF initiatives to promote urban morphology and develop joint applications for European funding.

Consolidation of PNUM will involve the development of a number of initiatives in 2011: the publication of a biannual newsletter; the publication of a bilingual book on the study of urban form in Portugal, with contributions by members; and the organization of an annual conference, the first of which will be in mid-2011.

A website has been launched (http://pnum.fe.up.pt). It contains information about how to join PNUM, resources, a bibliography, the constitution, newsletters and information about conferences.

For a review of the study of urban form in Portugal see this issue, pp. 55-66.