

Understanding the Mechanisms and Impact of Growth on the Urban Form and Functioning of Cities: An Application to the Case of Limassol

*By Ilaria Geddes**

In the great majority of cases cities have been steadily growing and becoming increasingly complex. Growth may have occurred at different times and its characteristics may vary depending on the geographical location of the city and its socio-economic context. However, it remains that common features, growth mechanisms and regularities are persistently found. These must be understood and exploited in our attempt to sustain better living environments. A key problem in our ability to analyze the complexity of the urban form is the long-standing isolation of analytical approaches developed in different countries and research environments. Even harder is to devise and agree on a system of analysis able to capture the universal mechanisms through which cities change and assess how such changes impact on the functioning of cities, providing the evidence base to manage, mitigate and exploit the impact of growth and urban transformation. This paper presents a transdisciplinary approach to urban analysis, which enables the deployment of multiple methods under a common framework. The approach is taken from the field of philosophy, specifically assemblage theory; within this, a combination of social research methods and urban analysis tools are integrated to provide a comprehensive methodology for diachronic analysis of city development, enabling the understanding and assessment of growth patterns. The approach was tested on Limassol, Cyprus: a diachronic analysis was carried out using historical research, interviews, space syntax, block size and land use analysis, mapping of contemporary census data, and illustrative case studies. The aim was to identify the mechanisms of growth which led to Limassol's specific urban form and identity. This paper presents the key research findings and discusses the extent to which the proposed approach enabled the identification of causal pathways of development and of how the growth processes led to specific morphological and functional characteristics of the city.

Keywords: *Diachronic Analysis, Growth, Limassol, Relational Theory, Urban Development.*

Introduction

Over the centuries Mediterranean cities have fascinated travelers, historians and geographers along with architects and urban scholars. They sometimes come to symbolize a concept and end up being the focus of romanticism and exoticism; they often ignite strong feelings of belonging as well as rivalry between them. However, while as citizens, residents or visitors we might love them or hate them, as scholars,

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once we try to explain them, we are still challenged by their complexity. The array of elements that make up a city, the relations between them, and the causal pathways that give a city its identity or characteristics, remain difficult to describe, map and analyze coherently.

This problem is intensified in contemporary cities which are frequently characterized by new forms of closure and exclusion (Wacquant 2008), increasing social, economic, political and spatial fragmentation. In particular, the modern city has seen a shift in its physical form and has moved from an urban fabric which was dense and continuous to one that is more diffused, discontinuous, open and atomized (Levy 1999). Southern European cities, coastal and port cities are currently more exposed to such rapid physical and social changes and the experience of migratory influxes and ephemeral settlement by transitory groups. This socio-economic diversification of cities may also emphasize or challenge key spatial elements of the urban fabric and patterns of coexistence between urban communities (Maloutas and Souliotis 2015).

This is why the problem of understanding the mechanisms and impact of growth is of renewed importance in light of ever-increasing complexity, because it is vital to our ability to develop tools and skills to ensure a successful, sustainable and equitable future for our urban environment. While the factors influencing growth and the characteristics of each city may vary depending on the geographical location of the city and its socio-economic context, it remains that common features, growth processes and regularities are persistently found. A renewed understanding of the nature of cities is key in advancing appropriate tools and methods of analysis that take into consideration the multiplicity of the physical and social aspects of a city, as well as the elements and actors that play a role in their transformation. Such tools are needed to ensure that contemporary cities are equipped with the ability to understand the possible impacts of rapid or simultaneous changes and developments (Marcus and Colding 2011).

A key problem in our ability to understand the complexity of the urban form is the long-standing isolation of the analytical approaches developed in different countries and research environments. Such approaches are characterized by specific national trends and have seen the emergence of separate schools of thought. There are essentially four main approaches to the study of the urban form: the *configurational* approach, the *historical-geographical* approach, the *process typological* approach, and the *spatial analytical* approach. Each of these tends to be associated with a main research center or with individual researchers, and all have traditionally been applied in isolation. However, in recent years a number of studies, initiatives and events (Kropf 2009, Oliveira et al. 2014, Zhang 2015, Scheer 2016), have explored bridges between the different approaches to assess the viability of a common framework and of a multidisciplinary analytical approach. However, there are still limited analyses and elaborations of how the approaches are interlinked and how they can be brought together within a comprehensive framework.

Furthermore, the advancement of such comparative and multidisciplinary work is fraught with the difficulty of analyzing urban growth and the human intervention

in such growth that has occurred throughout centuries of urbanizations. Attempts to embed the temporal process in theorizations and methodologies for the study of cities' transformations are discussed in theoretical debates and do exist in empirical studies, but remain limited and are still not fully developed and exploited.

This paper proposes that using a relational approach, specifically assemblage theory (DeLanda 2006), as a broad framework to construct a comprehensive analytical approach to enable the encompassing of the multifaceted elements and processes that lead to the emergence and transformation of cities. It reviews key ontological issues and trends in urban theory to establish a theoretical framework for analysis. The focus remains on the form of the city and on constructing a comprehensive analytical approach. Therefore, the literature review is limited to the perspectives put forward by the scholarship of urban studies, while acknowledging that urban theory and practice are widely influenced by the field of sociology. Specifically, how different sociological and urban morphological approaches can be combined to address the problem of understanding city development is discussed.

Within the scope of this study is the identification of the need for enhancing the research on the relationship between the physical elements of a city and social changes that occur in the urban environment over time. The extent to which the material and social spheres, and the impact of the one onto the other, should be considered and analyzed within the field of urban morphology is discussed as part of the literature review. A theoretical framework is then set and a methodology for analysis developed based on the key elements of the various analytical approaches. The aim is to establish an effective way of identifying the key processes that lead cities to display their common as well as their specific urban characteristics. The methodology is then applied to the case of Limassol, Cyprus, in order to answer the research question: what are the key mechanisms operating to shape Limassol's form and functioning?

The main findings ensuing from the space syntax analysis, the historical research and interviews are then presented. The analysis is specifically concerned with key physical elements of the city and their properties (the street network and its configuration), key socio-economic factors, and the reasoning behind planning decisions. This approach aims to produce new insights into the complex relationship between the spatial and social dimensions of the city and into the processes of change displayed in the patterns of the city through time. The results are discussed with regards to the extent to which the framework enables the identification of causal pathways of development, and how the growth process impacts on the form and functioning of the city.

Literature Review

There are many ontological questions regarding the nature of cities, probing whether they are whole discrete entities, if they have generic properties, or what constitutes their identity. Ontological concerns are reflected in varied debates ranging from relatively mundane comments about the economic and social value of being a city (Bevan 2014), interpretation of place (Seamon 2015), and theoretical discussions about the definitions and meanings of the variety of terms that identify urban settlements (McGrath and Shane 2012). Such ontological questions have implications for the way cities are conceptualized and thus the way we approach their analysis.

This paper addresses essential ontological concepts: the dichotomies of *universals* and *particulars*, and of *determinism* and *indeterminism* by proposing a theoretical and analytical framework which aims to enable the identification of the processes of emergence and transformation of cities. Universals are those elements and processes – the invariants – which are identifiable across all cities, the morphogenetic rules which are said to give cities their universal characteristics. Particulars are those processes and features which are only identifiable in one or a number of cities and which give them their ‘peculiar’ individual nature. One aspect of the deterministic debate in urban studies focuses on whether there are and what are the causal pathways that lead to specific features and forms of cities. The other aspect debates whether and how the elements that constitute a city have an impact on the city as a whole and, in turn, whether the city has an impact on its constituting elements, in particular its population.

The author maintains that looking to philosophical approaches, such as Actor-Network Theory (ANT) (Latour 2005) and Assemblage Theory (DeLanda 2006), which address ontological issues and build upon scientific and empirical facts, provides the theoretical framework to deploy a trans-disciplinary methodology to analyze cities diachronically and to make inferences about the causal pathways that lead to the physical and social form of cities and to how cities perform (Charalambous and Geddes 2015).

Theoretical Premises: Relationality, the Social and the Physical

Cities are invariably a collection of material entities, but they are also a system of human activity and interaction. Whether the two are separate dimensions where the material and the spatial, and their organization, act as a background and a context to human relations, or whether the two are inextricably linked and influence each other is still an open question in the scholarship on cities. Spatial organization and structuring as a reflection of social relations, cultural trends and economic factors, is a long-established idea which spans the work of urban sociologists from diverse backgrounds, such as Simmel (2004), Lefebvre (1991) and Logan and Molotch (2007). What is still highly debated is whether the organization of space and the physical form of the city has an impact on society. The analysis of the relationship between urban space and society was initiated by Charles Booth

(1897). Many of the issues identified by Booth's study on the distribution of social classes in London informed urban sociological studies developed by the Chicago School in the 1920s. This body of work, analyzing the distribution of various social characteristics within cities, remains pioneering in its view of urban contexts as structured in time by habitual social practices (Charalambous 2018). Despite the criticism of stereotyping social groups, such social approaches continue to be the foundation of socio-spatial theorizations of the city and of understanding the role of the urban environment in producing social outcomes (Tonkiss 2005).

When analyzing cities' historical evolution, urban theorists have tended to focus on physical aspects, while sociologists have highlighted the impact of population groups on the form of the city and the significance of prosaic and routine social activities in shaping the identity of a city (Charalambous 2018). The focus of urban scholars on physical aspects is particularly evident in the various approaches of urban morphology, which persist in setting the physical form (street, buildings, plots, areas, lines, etc.) as the key feature for analysis. While all urban morphological approaches have invariably included, to different extents, socio-economic aspects in their frameworks, analyses and interpretations, the view remains that the physical form should be used as a common reference in urban analysis (Kropf 2009). The question remains as to whether this is enough to deliver fruitful findings and understanding of the processes of urban development. The author takes the view that, as Hillier and Vaughan argue, the city is one single entity where the physical and the social "act conjointly to produce significant outcomes" (Hillier and Vaughan 2007) and that a way to address this issue is to bring the different perspectives and combine the tools used by different approaches under a common framework based on relationality. This offers the opportunity to put the physical and social aspects of cities on the same par.

Relational theories, such as ANT and Assemblage Theory, highlight a number of key issues in the knowledge domain of urban development, in particular regarding the mechanisms of emergence and transformation of city forms. They effectively argue how both material and human elements play an 'equal' role in emergence, how the connections between these define the nature of assemblages and how multiple scales and relations determine transformation processes. Both these relational theories suggest that to develop a research approach which can respond to the challenge of analyzing the processes of urban development which shape the city, it is necessary to:

1. Assess the relationships between material and human components.
2. Account for historical processes.
3. Analyze different scales of relationships between parts and the whole.
4. Understand how groups are formed and redistributed.
5. Construct a narrative where the variety of actors is represented.

Assemblage theory is a philosophy offering a holistic understanding of the city which is able to overcome the traditional divisions of specialization of the various fields which deal with urbanity. The points above provide the theoretical basis and

general guidelines to respond to the problem of the city and its key ontological issues. However, the fact remains that relational theories tend to be highly generic in proposing analytical approaches: exactly what elements, scales and interactions should be taken into account for analysis remains open for debate. This is not necessarily a shortcoming, but something that should perhaps be viewed positively as enabling those with specific information and skills to develop analytical approaches best suited to the study of the urban form and to specific case studies (Batty 2013, Bettencourt 2013). In order to develop an analytical approach, it is therefore necessary to draw from the specific approaches that have so far been used for the study of the urban form.

Urban Morphology: Understanding City Development

The study of cities' evolution, referred to here as diachronic analysis, requires the capability to link all these different elements, historical and geographical, and relate them to each other in a meaningful way, so as to draw inferences as to the nature of changes in each element and how these interact spatially and over time.

Diachronic analysis of cities aims to study the human form of settlements and the process of their formation and transformation. In order to fully understand contemporary city form and aid planning in its interventions into the existing fabric, as well as in setting effective policies for growth, it is vital to establish what characteristics of the city should be studied and what approaches are commonly used for such research. Diachronic analysis remains a challenging area for scholars in different fields, as the complexity of cities makes them particularly hard to analyze, especially across time. In order to address this problem a theoretical framework of what a city is and how it evolves needs to be set for an effective analytical approach to be put in place.

Furthermore, assessing how cities have developed requires both accurate cartographic records as well as historical and current sources of information on their demographics, their history and their land uses. Many historical records and data, even within a short time span, are not easily comparable to current ones. At the same time differences in the quality and detail of cartographic records means that analytical tools able to capture specific properties of cities, regardless of the information available, are needed in order to assess changes in the built form, identify what processes enable such changes and relate these to the ways in which cities function.

Despite these barriers to the analysis of city development, the scholarship in the field of urban morphology is vast. Different methodologies have been implemented to approach the analysis of the evolution of cities, but have often been applied in isolation and are characterized by specific national trends which have led to the emergence of separate schools of thought. The main approaches and their related schools of thought are: 1) the historical-geographical approach of the British school of town plan analysis initiated by M.R.G. Conzen in the 1960s; 2) the process typological approach of the Italian school based on the work of S. Muratori in the 1940s; 3) the configurational approach developed by Hillier and Hanson

(1984) and the space syntax community based at University College London (UCL) and now applied by different scholars across the world; and 4) the spatial analytical approach which is applied through a variety of methods by different scholars within the wider theory of cities as complex systems, but is mostly associated with the work of the Centre for Advanced Spatial Analysis (CASA). These are comprehensively reviewed in other publications (Kropf 2009, Oliveira 2016, Scheer 2016, Charalambous et al. 2019), therefore, here only a description and comparison of their main characteristics relatively to using a relational framework for analysis is given.

All approaches offer certain analytical benefits, but also have shortcomings, mostly relating to their ability to account for wider structural factors in their analysis of form. This is perhaps understandable as all the approaches which specifically deal with form tend to originate from the field of urban studies – more concerned with local processes – than from the field of sociology – more concerned with global processes. However, all also seem to be open to the possibility that inferences can be made with regards to wider factors influencing the evolution of form. All the approaches can be applied ‘statically’ to analyze the urban form at one specific point in time, but their basis can be used as the foundation for diachronic analysis.

To give a clearer overview of the commonalities and differences of the approaches, the key physical and social elements and the way they view relationality is summarized in Table 1.

Clearly, there is no single aspect of either physical form or social feature which is common to all the different approaches, although different components and relations tend to recur through two or more approaches. Function and use are clearly the social aspects that are consistently adopted for analysis.

Temporal relations seem to be the most consistent across the approaches (though using somewhat different semantics): cyclical/continuous processes and change, modification, diversification or readjustment are compatible descriptions of emergence and transformation. However, different scales and degrees of determinism are clear in the variety of views of the human-physical relationality offered by each approach.

This is why an overarching theoretical framework which establishes the extent to which local and global processes should be given consideration in analytical attempts is needed: assemblage theory provides such a theoretical framework. It sustains the argument that the physical and human aspects of cities are inextricably linked and should therefore be analyzed together as they jointly define the identity of a city. It also makes clear that an analysis that is devoid of historical processes or of the distribution of variations across a population cannot fully explain the emergence of cities and the processes of persistence and change; which physical and human elements, how to identify interactions, how to measure connectivity, what scales, variables and historical processes should be considered have to be informed by the various morphological and social approaches mentioned above.

Table 1. Components of the Urban Form and their Relationality Identified by the Different Urban Morphological Approaches

| Approach | Physical Features | Social Features | Spatial Relations | Human-Physical Relations | Temporal Relations |
|--------------------------------|---|---|--|--|---|
| Historical-Geographical | <ul style="list-style-type: none"> • Site • Town plan (Street, plot, building) | <ul style="list-style-type: none"> • Function • Land use • Pattern | <ul style="list-style-type: none"> • Street Pattern • Plot Pattern • Building Pattern | <ul style="list-style-type: none"> • Social and Economic context | <ul style="list-style-type: none"> • Cyclical Change |
| Process Typological | <ul style="list-style-type: none"> • Building • Urban Tissue • District • City | <ul style="list-style-type: none"> • Cultural Context • Historical Context | <ul style="list-style-type: none"> • Aggregation | <ul style="list-style-type: none"> • Intension • Construction | <ul style="list-style-type: none"> • Derivation (Cyclical Reproduction Modification of form) |
| Configurational | <ul style="list-style-type: none"> • Street • Open Space | <ul style="list-style-type: none"> • Use • Occupation • Movement | <ul style="list-style-type: none"> • Network Structure • Interconnectivity | <ul style="list-style-type: none"> • Perception • Movement Economy • Cultural context | <ul style="list-style-type: none"> • Cyclical Growth • Diversification |
| Spatial Analytical | <ul style="list-style-type: none"> • Pilot • Parcel • Census Tract • Built-up Area • Route | <ul style="list-style-type: none"> • Use | <ul style="list-style-type: none"> • Network Structure | <ul style="list-style-type: none"> • Flows | <ul style="list-style-type: none"> • Feedback (continuous Readjustment) |

Source: Author.

Methodology

Assemblage theory affirms that social entities are constructed through very specific historical processes, which indicates the need for diachronic analysis. This need was met by building a systematic spatial history of the city, an approach concerned directly with the relationship between spatial and locational factors at specific times in the past as described by Baker (2003), and by contextualizing such history with a narrative.

The analytical requirements and the related tools selected to perform the analysis from the various sociological and urban morphological approaches are summarized in Table 2.

Table 2. *Summary of Methodological Tools Used for Each Analytical Requirement*

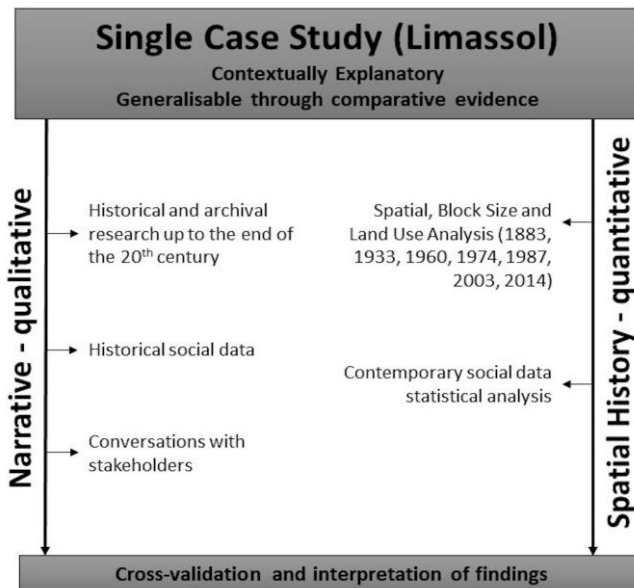
| Analytical Requirement | Qualitative Tools | Quantitative Tools |
|---|---|---|
| Historical Processes and Temporal Aspect | <ul style="list-style-type: none"> • Historical Narrative • Review of Secondary Sources on Development | <ul style="list-style-type: none"> • Spatial History • Space Syntax Analysis • Block Size Analysis • Land-use Analysis |
| Different Scales and Relationship of Part-to-Whole | <ul style="list-style-type: none"> • Illustrative Case Studies – How They Relate to the Whole City | <ul style="list-style-type: none"> • Space Syntax Analysis • Assessment of Fringe Belt Formation |
| How Material and Human Elements are Connected Together | <ul style="list-style-type: none"> • Fabrique Urbaine • Analytical Linkages between Historical Sources and Physical Development | <ul style="list-style-type: none"> • Statistical Correlations between Physical and Social Factors |
| How Groups are Formed and Redistributed | <ul style="list-style-type: none"> • Historical Analysis of Events that lead to Group Formation • Analysis of Groups' Expressive Characteristics within Case Studies • Analysis of Primary Sources in Relation to Case Studies' Developments | <ul style="list-style-type: none"> • Basic Statistical Analysis of Historical Social Factors • Details Statistical and Geographical Analysis of Groups' Distributions |
| A Narrative where the Variety of Actors is Represented | <ul style="list-style-type: none"> • Conversations with Stakeholders | <ul style="list-style-type: none"> • Quantitative Information Relating to the Nature of Groups in Different Areas |

Source: Author.

Based on the analytical requirements discussed in the literature review and the available tools, a research strategy was developed proposing to deliver two parallel accounts of Limassol's development. On the one hand is a narrative which describes, through historical research, how the city has grown and changed; on the other hand, is a spatial history of the city, which focuses on systematically and

quantitatively analyzing the development of the city's street network and its built form at specific points in time. This spatial history attempts to build a timeline of the city's development to identify how the sequence of physical events in the growth of the city affects its spatial and physical properties at different scales. At the same time, accounts of the actors involved in decision-making, the reasoning and forces behind certain planning decisions are reported and discussed through conversations with a variety of stakeholders. The research strategy including methods and tools is summarized in Figure 1.

Figure 1. *Research Strategy*



Source: Author.

Spatial History

The spatial history was composed of three layers of information relating to the material components of the city: an analysis of the spatial properties of the street network, an analysis of a physical property of the built form (block size) and an analysis of a socio-economic property of the built form (land use). The first analysis was carried out through a configurational, space syntax approach (Hillier and Hanson 1984, Griffiths 2012, Hillier 1996), while the second two analyses were carried out through a historical-geographical approach (Whitehand 2001, Oliveira 2016) focusing on the timeline and distribution of specific land uses of a large size. The spatial history comprises seven points in time (1883, 1933, 1960, 1974, 1987, 2003 and 2014). One further layer of information relates to the social components of the city: an analysis of distribution of social groups across the city was carried out through a geographical approach typical of the Chicago school, whereby contemporary census data (from 2011) were summarized and mapped according to administrative areas. Of the spatial history, only the configurational - space syntax - analysis is presented within the scope of this paper.

Space Syntax Methodology

Space syntax methodology provides an analysis of the city at different scales and has the ability to highlight how the main structure of the city changes over time by quantitatively describing patterns of spatial layout and by measuring the accessibility level of all elements in the system. The most important measures of space syntax are *integration*, representing ‘to-movement’ or the accessibility of a specific element within the system, and *choice*, representing ‘through-movement’ or ‘betweenness’ (the number of times a segment falls on the shortest route between all pairs of segments within a specified radius). Measures can be calculated at the city-wide scale or at any given radius; the city-wide, ‘global’ measures taking into account all elements in the system and the ‘local’ measures taking into account all elements within the given radius. The specific analysis used in this study is angular segment analysis (Hillier and Iida 2005), which takes into account the relative straightness of a route. The measures used are *normalized angular choice* (referred to here as NACH or ‘choice’) and *normalized angular integration* (referred to here as NAI_n or ‘integration’). The normalized measures allow for comparison between systems of different size (Hillier et al. 2012).

NACH values range between 0 and 2, where values above 1.3 are considered to be in the top range of accessibility, and values of 1.5 or above being extremely high. NAI_n values also tend to range between 0 and 2, but can reach much higher values at the local level. All the segments in the system with values of 1.3 or above are considered here to be part of the core structure of the city – the global structure when considering the whole system or the local neighborhoods’ structure when considering a specific radius. These two cores can be matched to identify the *multi-scale* core of the city (Versluis 2013) – all the segments which have both the highest global and local values, constituting areas which are likely to have the highest levels of both vehicular and pedestrian movement, as well as the greatest mix of uses and.

Another property of these measures is that maximum values tend to be representative of what is known as the foreground structure of the city – the network of linked centers at all scales, while mean values tend to be representative of the background structure – the network of residential spaces. (Hillier 2002, 2012)

Narrative

Narratives are a main tool of historical research, but they are not commonly used in urban analysis, especially for contemporary times. In the context of this study’s framework, the meaning of ‘narrative’ as a research method is taken from ANT, which requires to provide a description where all the actors involved in the process of emergence are accounted for and their actions are outlined. The aim of the narrative is to fully depict the state of affairs of an assemblage (in our case the city) by being specific and accurate while capturing the broad-ranging connections and capacities exercised by different agencies and components. However, here, the author is not using ANT methodology to construct a narrative, which would

involve the tracing of a network. Instead, a combined approach is taken, where the narrative is only one of the many analytical elements required by the theoretical framework. For this reason, a combination of tools, typical of more 'classic' social and historical research using narrative as a qualitative method is employed. The narrative itself was developed by the researcher (as according to ANT), but through the collation, description, interpretation and communication of existing knowledge of the city. This was collected through researching primary and secondary sources, including photographic and cartographic material, and press archives, as well as through holding interviews with expert stakeholders; the methods used for each of these actions are described below. Within the scope of this paper a brief version of the narrative relating to the impact of historical and recent developments on the current functioning of the city, is presented here. The full historical narrative, and more detail about the methodology, is reported elsewhere (Geddes 2019, Geddes and Charalambous 2017).

Historical Research

The historical context within which Limassol developed was investigated through a literature review of secondary sources. Substantial research on its urban history has been compiled by Serghides (2012) in a book which focuses both on the growth of the city and the development of specific areas and architectural landmarks, but in particular, its industrial development. Primary sources which describe the city were found in a small number of historical tourist guides and historical travelers' diaries from which the information regarding Limassol was collated by Severis (2006). Other primary sources used were the newspaper archives of the Cyprus Press and Information Office and the online archive of the newspaper Cyprus Mail. Information which could not be found in written sources and further detail about the reasons behind each development was discussed in interviews with selected expert stakeholders.

Interviews with Expert Stakeholders

Interviews with expert stakeholders had the dual purpose of retrieving information which is lacking in the available historical documentation, and of collating a variety of different viewpoints on the reasoning behind development and on the actors involved in the planning processes. Firstly, the interviews aimed at clarifying some of the mechanisms of the city's development and retrieving the dates of planning and construction of major routes and building projects. Secondly, they attempted to gauge expert opinions on the value of various projects, especially the most recent ones and the current local plans, as well as the systems in place to elaborate needs assessments, encourage effective public participation, and establish criteria on which to assess the potential value and impact of planning proposals.

A total of six in-depth interviews were held with the experts; these were semi-structured. A set of questions was prepared in advance of each interview; probes and additional questions were brought up during the conversation as a result of

what the interviewee said as and when the researcher estimated it to be relevant. The remainder of questions related to themes relevant to each expert. All interviewees were also asked to suggest at least three priorities for the future development of Limassol; this was the more open session, requesting the expert's personal opinion on the current planning system, recent developments in Limassol, the city's current situation and its needs for the future. The material was embedded in the narrative, used to aid the identification of the mechanisms of the city's development and to make inferences about the relationship between the physical and the social spheres.

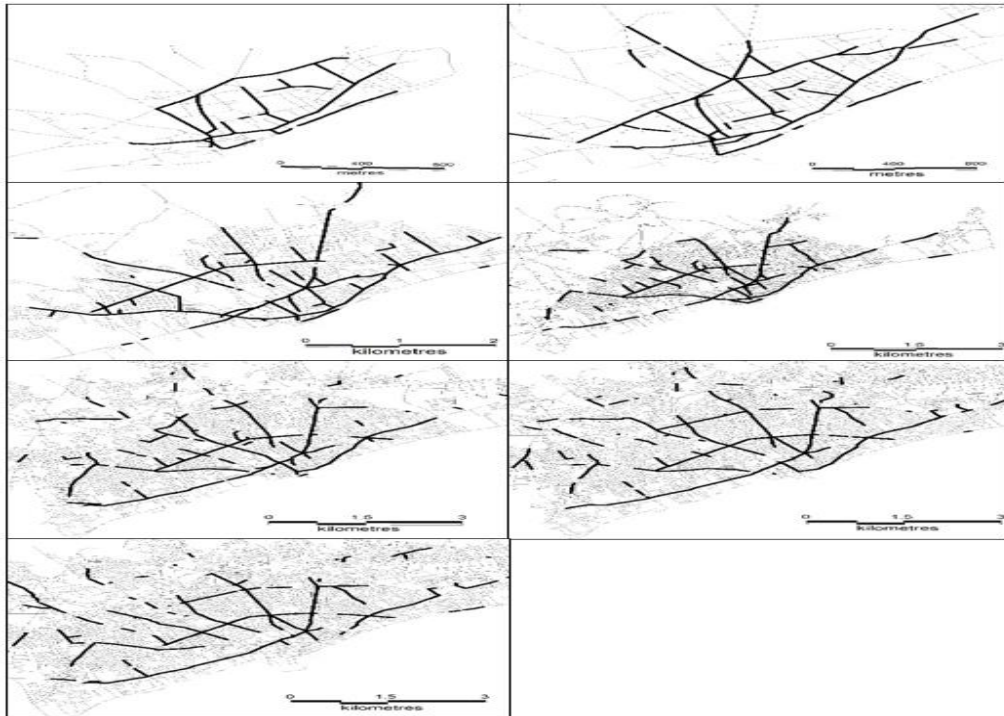
Findings from the Spatial History of the City

Previous spatial analyses of Limassol's growth have pointed out that uncontrolled urban development led to an uneven expansion of the city, creating a fragmented structure and leaving many gaps in the urban fabric (Kritioti 1988). This state of affairs may perhaps be attributed on the one hand to the leapfrogging of suburban growth and on the other hand to development that favored extensive vehicular access and abundant parking spaces.

The space syntax analysis provides us with an array of information about the overall structure of the city and its development through time. Figure 2 shows that as the city develops, its core (highlighted by the thick black lines) shifts towards the ring roads and new areas of nearby villages. This core is measured as the relations between different scales of accessibility: all the street segments, which are highly accessible at both a local radius and at the whole-city scale. The core also becomes more scattered and includes more of the distant areas in the northern edge of the city. As time goes by, the seafront seems to lose its importance and at present it no longer belongs to what is deemed the 'spatial' center of the city.

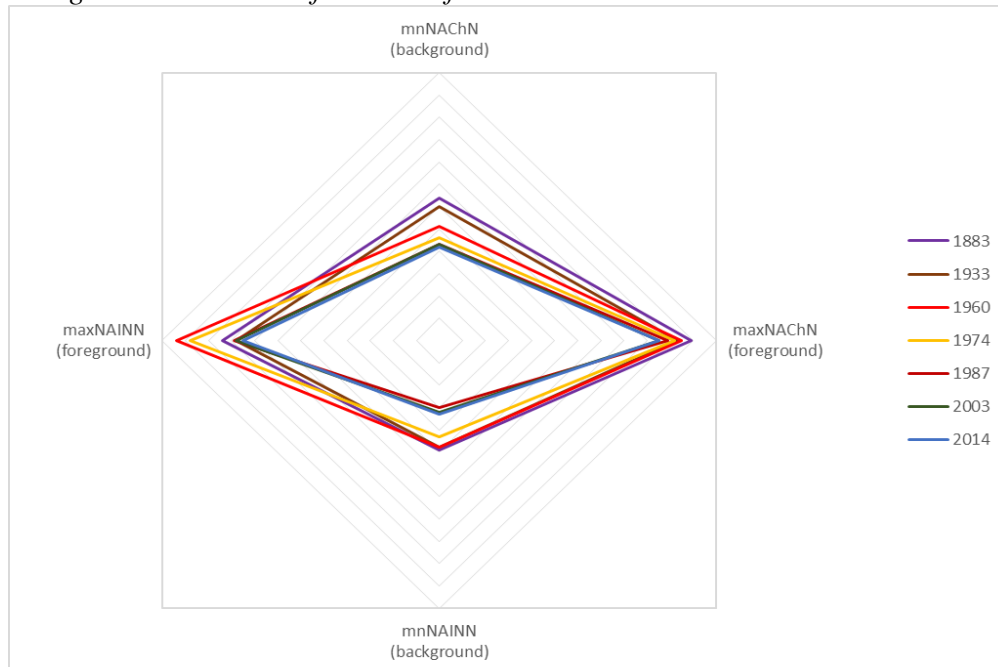
This configurational analysis tells us how continuous or fragmented, and how accessible, are the foreground and background structures of the city (Hillier et al. 2012). The relationship between these two structures can be visualized as a star diagram (Figure 3). This diagram is a diachronic adaptation of the same type of representation used synchronically to compare cities in Hillier et al. (2012) and has the capacity to compare the relative importance of the foreground, main circulation system of the city, and the background residential network. It shows that the city constantly has a longer horizontal axis, which tells us that the foreground system dominates the city. It also shows that the background, residential system loses its continuity and integration more sharply than the foreground system, and that the latter has a clear peak in integration in 1960-1974. Furthermore, it is evident that change in these properties seems to stabilize after 1987, with less dramatic changes, but a small improvement in the integration of the background network matched by a small decrease in that of the foreground network is visible in 2014.

Figure 2. Multi-Scale Accessibility Analysis of Limassol (Left to Right and Top to Bottom: 1883, 1933, 1960, 1974, 1987, 2003 and 2014)



Source: Author.

Figure 3. Star Diagram of the Changing Properties of Foreground and Background Structures of Limassol from 1883 to 2014



Source: Author.

A brief comparison of the spatial properties between the city as a whole and the historical town center (Table 3) reveals a somewhat similar pattern of spatial change. There are, however, important differences in the relationship between the town center and the whole city. Firstly, the background structure within the town center is more continuous and more resilient to change as the lower decrease in mean choice shows, while its integration, despite some decrease over time, especially in 1974, has a striking continuity and is now back to the levels of the late 19th and early 20th century. Secondly, the decrease in both continuity and accessibility of the town center's foreground network is much sharper than for the whole city. This indicates that its strength is more susceptible to the impact of growth and that its role in distributing and attracting long range movement is more effectively diminished by the incorporation of new routes and new areas in other parts of the city.

If we look at local to mid-range measures for the whole city and the town center (Table 4) we will notice that, after initial development, integration values drop from 1933 onwards, which indicates that local neighborhoods on average become less and less integrated even within their local area. The picture is different for the town center taken as a separate unit – values here are more variable over time and are generally high, meaning that while shifts do occur in its properties as an attractor of movement and a to-destination, it steadily functions well as a local neighborhood. The values drop somewhat in the years during which it is known to have decayed, but have recently risen again.

Table 3. *Comparative Table of Mean and Maximum Global Choice and Integration Values of the Whole City and the Town Center Over Time*

| | mnNACHN | | mnNAInN | | maxNACHN | | maxNAInN | |
|-------------|---------|------|---------|------|----------|------|----------|------|
| | | | | | | | | |
| 1883 | 1.24 | 1.26 | 1.09 | 1.10 | 1.69 | 1.70 | 1.54 | 1.54 |
| 1933 | 1.20 | 1.24 | 1.08 | 1.10 | 1.63 | 1.63 | 1.48 | 1.48 |
| 1960 | 1.11 | 1.20 | 1.08 | 1.08 | 1.65 | 1.58 | 1.74 | 1.59 |
| 1974 | 1.06 | 1.14 | 1.03 | 1.03 | 1.62 | 1.50 | 1.68 | 1.50 |
| 1987 | 1.03 | 1.11 | 0.90 | 1.07 | 1.59 | 1.45 | 1.49 | 1.34 |
| 2003 | 1.03 | 1.09 | 0.92 | 1.07 | 1.55 | 1.42 | 1.48 | 1.33 |
| 2014 | 1.02 | 1.11 | 0.93 | 1.10 | 1.55 | 1.42 | 1.45 | 1.35 |

Source: Author.

Table 4. Comparative Table of Mean Local Choice and Integration Values of the Whole City and the Town Centre over Time

| Year | mnNAIn | | | | | | mnNACh | | | | | |
|------|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|
| | WC 800 | WC 1200 | WC 1600 | TC 800 | TC 1200 | TC 1600 | WC 800 | WC 1200 | WC 1600 | TC 800 | TC 1200 | TC 1600 |
| 1883 | 1.20 | 1.14 | 1.12 | 1.20 | 1.50 | 1.12 | 1.12 | 1.14 | 1.12 | 1.13 | 1.16 | 1.18 |
| 1933 | 1.44 | 1.23 | 1.17 | 1.33 | 1.35 | 1.37 | 1.19 | 1.19 | 1.21 | 1.15 | 1.19 | 1.21 |
| 1960 | 1.17 | 1.12 | 1.11 | 1.37 | 1.37 | 1.38 | 1.12 | 1.14 | 1.15 | 1.16 | 1.19 | 1.2 |
| 1974 | 1.10 | 1.04 | 1.03 | 1.43 | 1.45 | 1.44 | 1.11 | 1.12 | 1.13 | 1.16 | 1.19 | 1.13 |
| 1987 | 1.02 | 0.96 | 0.94 | 1.34 | 1.33 | 1.33 | 1.09 | 1.1 | 1.11 | 1.16 | 1.18 | 1.19 |
| 2003 | 0.98 | 0.93 | 0.91 | 1.30 | 1.29 | 1.28 | 1.09 | 1.10 | 1.11 | 1.16 | 1.18 | 1.18 |
| 2014 | 0.99 | 0.94 | 0.92 | 1.34 | 1.33 | 1.32 | 1.09 | 1.10 | 1.11 | 1.16 | 1.18 | 1.19 |

Source: Author.

Through the historical process, the global structure of the city has shifted from the historical centre outwards. As indicated by previous studies in similar contexts (Shpuza 2009), the city's overall integration tends to decrease with growth. However, this is not necessarily an endless or irreversible pattern. The spatial analysis highlights the two key problematic patterns of the city: the domination of the foreground structure over the background one and a lack of sub-centers. More importantly, it shows that the recent redevelopment focus on the waterfront has not reintegrated it within the spatial core of the city and the fact that the array of recent developments has not altered the dominance of the foreground structure or significantly improved city-wide accessibility levels. Small improvements have occurred in the localized area of the town center, but certainly, no significant positive impact has occurred across the city.

Findings from the Narrative of the City

Limassol was little more than a village in 1815, when the traveler William Turner states that Limassol "is a miserable town consisting of 150 mud houses of which 100 are Greek and 50 Turks" (Turner 1820). During the second half of the 19th century Limassol began to grow and expand substantially. This was reflected in the construction of the earliest functional space outside the edge of the city: the Greek cemetery of Agios Nikolaos. A Muslim cemetery at the western edge of the city is also visible in the 1883 map, but much nearer to the urban area. These larger peripheral land uses were followed by the construction of the Commissioner's house in 1875 in the east of the city and the Commissioner's depot in the north. By the end of the Ottoman period geographical divisions related to ethnicity had become more and more spatially defined along with other social factors, such as social class (Pilavakis 1977).

With the end of the Ottoman period, Limassol developed as a city of proto-industrialization, as the economy benefited from the stationing of British troops in the district, with consequent development of establishments and retail facilities in the town. During Ottoman times the bazaar and the main commercial street were in

the western side of the town (Severis 2006) and on the coastal road (Serghides 2012). However, as the British settled in, the commercial center started shifting towards the east. The reasoning – if any – behind the location of these various components of the city remains unknown and an official masterplan of any kind to refer to was not drawn by the British (Interview 1). Although much infrastructure was built and the city started expanding once British administration began, development moved slowly. From the beginning of the 20th century, however, physical and social change in the city sped up with the Government providing financial assistance to the municipality in order to support certain public works, especially those relating to improvements for the shipping industry. A concentration of industrial land uses along the coastline to the west of the old port, a somewhat separate industrial area, was formed during these years and to a great extent still remains in place.

At the same time, the first promenade along the coastline was constructed. The houses along the seafront that formed a ‘wall’ against the sea were removed – this is the time when Limassol first ‘opened up’ to the sea. The purpose of this was to support shipping, with loading and unloading being the main activity taking place along the promenade. However, this area was quickly turned into a social and recreational space during quiet times for the industry and during holidays (Serghides 2012).

On the one hand, shifts in global political affairs, such as the oncoming of the British rule, relate to development in the periphery of the city, the establishment of specific land uses and shifting of the commercial center. On the other hand, a local physical change in the urban fabric, such as demolishing a series of buildings, leads to a reframing of the relationship of the city with the sea and the functioning of its coastal area.

Serghides (2012) suggests that the development of shipping, mostly due to Limassol’s wine and carob industries, coupled with increasing urbanization, led to a fast ‘Europeanisation’ of the city and the population. He suggests that the Public Regulations of the city, first set at this time, were developed to promote new, more western, social codes.

During the colonial period and in the years following independence up to the 1974 war, Limassol’s urban population grew ten-fold. Although there was a steady population increase in the whole island following British infrastructure works in all towns, the relative distribution of population between town and country did not change drastically until the 1920s. This was a period of depression in agricultural prices, which saw migration into towns leading to an increase in the urban population at twice the rate of the rural population between 1921 and 1946 (Kritioti 1988).

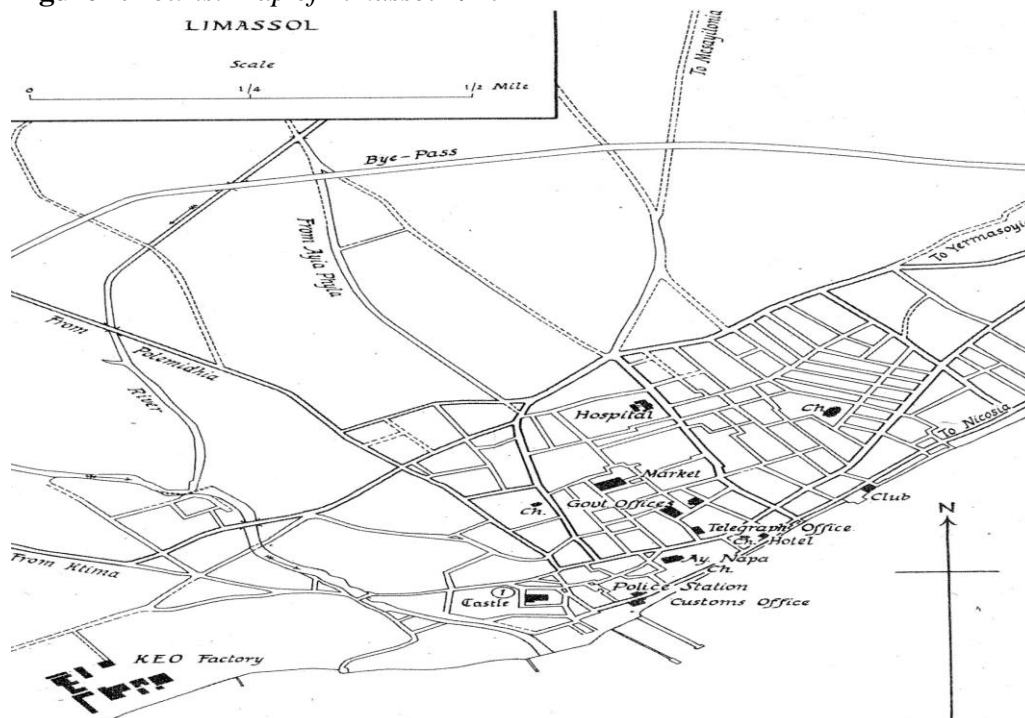
Severis (2006) gives a variegated view of Limassol’s cosmopolitanism in the first decades of the 20th century. The variegated social life was matched by wider, more structural socio-economic changes, as well as physical, material changes to the city that took place between the two World Wars. The increase in population in the 1920s, coupled with industrial development also led to the establishment of other uses and facilities in the city. Serghides sustains that socio-economic changes

and building activities were putting pressure on local authorities to produce a comprehensive plan (Serghides 2012). It is at this time that the bye-pass (Figure 4) was planned and then constructed at the beginning of World War II.

This is a key piece of road infrastructure which will permanently influence the form and further development of Limassol's street network. The reasoning behind the development of the road is, however, unclear. It has been stated to the author that the road was planned for military purposes during war times (Interview 1) or simply as a ring road to avoid traffic in central Limassol due to its expansion (Interview 3), or rather that it was built with the intention of avoiding having to circulate British military vehicles through the city thus causing increased congestion, but ultimately quickly became used for common traffic purposes (Interview 4).

Again, the narrative above highlights how the relations between global (fall in agricultural prices) and local factors (public regulations), as well as the relations between cultural (Europeanisation) and material (the construction of a ring-road) factors, conjointly act to shape the social and physical form of the city.

Figure 4. *Tourist Map of Limassol 1947*



Source: Mangoian and Mangoian (1947).

In 1947 Sir Patrick Abercrombie took part in a planning event where he gave his opinions about the current state of the city, as well as its present and future needs. He stressed the need to carry out a study of the city and to build up the empty areas within it; he suggested that construction should be remodeled in order to set a commercial center for the city, which should be pedestrianized. Furthermore, he stated that the road network should be reorganized with long-term views. The

contemporary local newspaper *Observer* supported his statements, further highlighting that a plan of action was needed, while Serghides (2012) points out that similar problems remain evident to the present day. In fact, it is not until 2014 that pedestrianization of the center is implemented, while empty areas within the urban environment remain common. Moreover, there is still no long-term masterplan with regards to the road network, a problem which is partly generated by the fact that many municipalities lie within the urban area. This is a long-standing issue in terms of the viability of a masterplan (Charavgi 1979a).

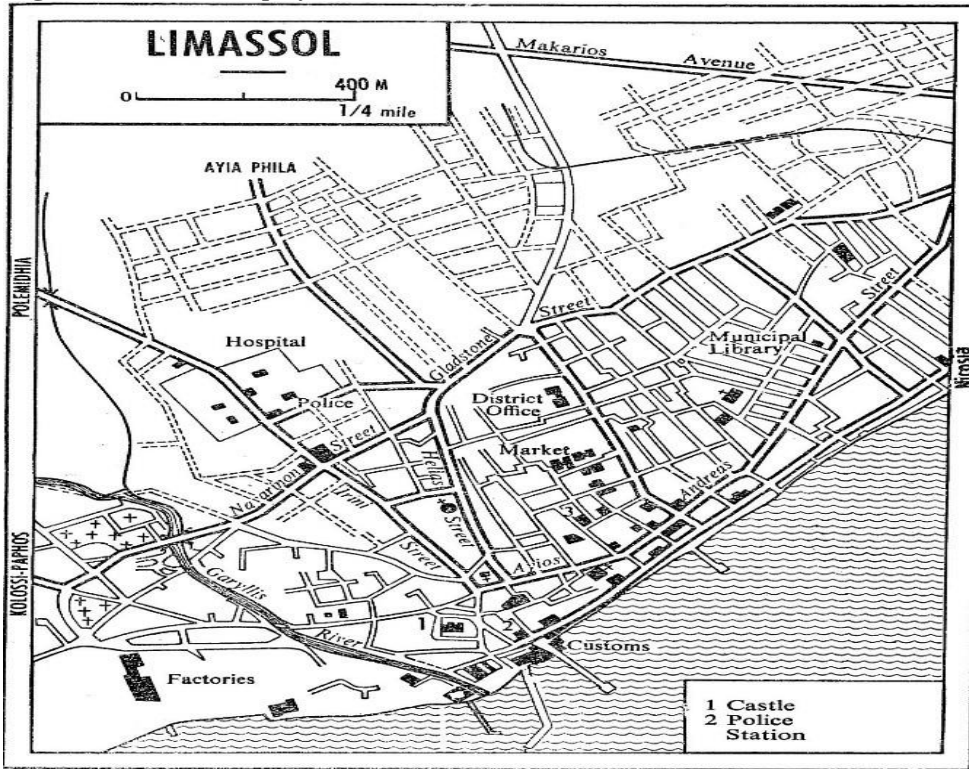
From the 1950s the expansion of the city continued radially, the second ring road of the city is planned, but will not see the light of day until the 1990s. At this time, the road of Gladstonos, bounding the historical center had started becoming a focal point of entertainment. This seems to indicate a shift of the leisure area from the coastline towards the north as the city expanded and a new boundary was created by the new ring road. Residential densification sped up in the 1960s. Much of this took place through the development of small detached homes by the middle classes, a trend different from that taking place in contemporary Europe, although the first few apartment blocks also appear at this time in Limassol. A few more industrial developments take place during this decade, but most of the development is residential until 1970. A tourist map of 1974 (Figure 5) poignantly shows the densification of the city following independence.

The establishment of a formal planning system at this time became more pressing than ever. The Town and Country Planning Law was published in 1972, but it will not be enacted and local plans not drawn until 1990. Because of this, development continued to be dispersed and unregulated.

At this time, the ring road (by-pass) of Makariou starts competing with the center and coastal area as a business, retail and recreation center. This was partly because works were taking place on the coastline to construct the beach and expand the promenade, but also because of the growth of the city to the north. This indicates a further shift of the center towards the north, as commercial activities also appeared on the main routes connecting the historical center with Makariou. Residential development continued to follow a model of detached homes and 'garden city' neighborhoods, which, according to Serghides (2012), failed to acquire a specific character due to the large number of empty spaces within them.

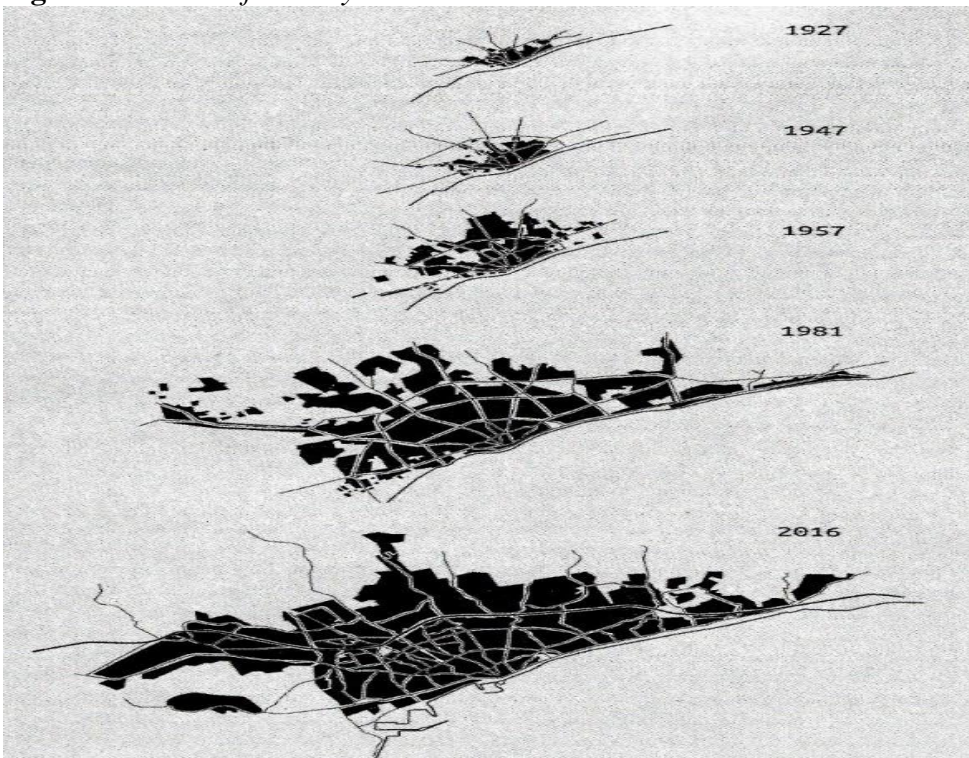
Following the 1974 war Limassol saw an unprecedented population growth with an almost 30% increase between 1973 and 1976. Most of this was due to the influx of Greek Cypriot refugees. The greatest portion of development during this period was constituted by residential construction to accommodate the refugees, and included housing estates in peripheral areas of the city, as well as much construction by the private sector. A true building explosion commenced around 1979; the city expanded significantly and finally engulfed nearby villages – the growth of the city during the 20th and 21st centuries is summarized in Figure 6.

Figure 5. *Tourist Map of Limassol 1974*



Source: Nagel Publishers (1974).

Figure 6. *Growth of the City 1927-2016*



Source: Lianou and Christofinis (2016).

Despite the great need for housing, density did not particularly increase; in fact, the city sprawled as housing estates were placed in very peripheral areas where the Government already owned the land or was able to purchase it cheaply, while the private sector, within a loose system of building regulations, was concerned with meeting market demands for detached homes. The problematic issue of the relationship between the whole city, the historical town center, the city's neighborhoods and sprawl identified by the spatial history is not only reiterated by the narrative, but also characterized by the varying scales of influence of local legislation and international struggles.

Because of the great expansion of the city in the 1980s, local authorities had to concentrate on addressing various problems which had come along with the drastic increase in population. The problems were widely debated in the press in the late 1970s and throughout the 1980s, which reveals a variety of issues relating to shipping, tourist, industrial and agricultural development, as well as housing supply (Simerini 1988, Charavgi 1979b).

The road infrastructure works of the 1980s and 1990s included the construction of the motorway and the second ring road, completed by 1987 and 1990 respectively. Why priority was given to the motorway remains unclear, though national-level policy would have played a significant role; one suggestion is that it was because of the influx of refugees into Limassol and its consequent expansion (Interview 2), another that private and economic interests played a role (Interview 1). The year 1990 was also a turning point as planning legislation was finally enacted and the first local plan was produced.

During the 1990s attention shifted back to the town center and the coastal area, which had decayed during the 1980s because of the focus put on new development in other areas of the city, and economic constraints affecting its commercial and entertainment establishments. During a strong local leadership from the middle of the 1990s to the middle of the 2000s, which thoroughly engaged in the regeneration of the town center, coupled with activism from local residents (Rakoczy 2007), the city has undergone much renewal. However, there remains some criticism that this is prioritized towards temporary, visitor, recreational and tourist uses, rather than focusing on a long-term, more sustainable regeneration aimed at bringing back permanent residents into the town center.

A piece-meal system of planning was in place until fairly recently, a factor which has greatly contributed to the sprawling nature of the city and to the continued existence of large empty areas within its form. Structural factors clearly played a role in how the city developed as did the local economy and the balance of power between institutions and private interests. While the economic situation does play a role in development, this narrative does not seem to show a strict link between certain economic conditions and the development of specific uses, especially in the early stages of development.

Throughout the city's growth, the local administration has given priority to maintenance, improvement and widening of existing roads, as well as construction of major new routes. Certain necessary establishments, such as slaughterhouses, the hospital, markets and the like were also prioritized by the local Government at

certain stages. However, while zones are designated for specific uses, the development of residential areas and their road infrastructure has been left to the private sector, with public facilities being added on at a later stage, once the population and the density increased enough to justify the effort and the cost. The relations between market interests and public sector planning seem to have led to a situation where the creation of long routes associated to some large land uses tends to lead the expansion process. Residential developments then follow, producing 'patches' of compact grids between and along major routes.

Regeneration and development projects in the center and along the waterfront since the 1990s aimed at addressing this issue. As mentioned above, these have brought renewal and vitality to the center, but criticism to the priorities set by the recent projects has also been raised. Despite changes and improvements made to public consultation processes in 2007, the feeling remains that a proper dialogue between citizens and planning authorities does not yet exist (Interview 1) and that often the requests and interests of land owners are met to the detriment of the public good (Interview 2).

Only environmental assessments are required in the case of large developments; traffic or commercial impact assessments are not compulsory under the current system (Interview 5). A variety of assessments is often sought to evaluate planning applications, however, these are not carried out by the authorities or independently, but by the developers themselves (Interview 3). Aside of guidelines set by local plans, there is no system in place to assess the impact of a single development on the whole city (Interview 3) and there are opinions that in many cases decisions are made which do not reflect the requirements of the plans or the views expressed in public consultations (Interview 2).

The widespread feeling about recent development in Limassol that came clearly across through all the interviews is that the flurry of activity is a highly positive trend. The redevelopment of the promenade was seen as particularly successful (Interview 5) and regeneration efforts as bringing Limassol to its best developmental phase (Interview 4) with its historic center blooming and booming once again (Interview 1). The Limassol Marina and the regeneration of the old port were also seen as positive interventions, but these were also fraught with reservations and discontent about their design, in particular the connections made between various redeveloped areas (Interview 1, 2 and 5), as well as criticism toward the architectural design of the old port (Interview 2 and 4). Regeneration of the town center also provoked mixed feelings with some seeing it as highly positive and successful (Interview 1 and 4), some thinking the effort was minimal (Interview 2).

When questioned about the balance of regeneration and development between the coastal area and other areas of the city, few were aware of any projects taking place outside the historical center or the coastline. Some thought that projects outside of the center, such as the linear park along the river, were positive (Interview 1); others thought that nothing of particular significance was taking place beyond the coastal area (Interview 2). At the same time, while all expressed generally positive views about the regeneration of the coastal area, when asked

about future priorities for Limassol almost all answers included the need to focus on local neighborhoods, mentioning the need to: make each neighborhood self-sufficient (Interview 1); build squares and green spaces (Interview 2), something that would make any city's neighborhood prettier and healthier (Interview 3); embellish the neighborhoods (Interview 4); strengthen other areas (Interview 5). Improvements in public transport coupled with solutions for parking problems also featured quite prominently in the conversations as to the priorities for the city.

Cumulatively, the interviews give the impression that the recent developments were beneficial to their own local areas and that due to their central and coastal location, the wider population benefits from them. However, the general view remains that these have not addressed the broader problems of the city and have not significantly altered either its problematic structure or local neighborhoods' access to better facilities. The tensions in the relations between the whole city and its different parts, and between the various agents and scales which structure the form and functioning of the city still remain in place.

Discussion and Conclusion

The quantitative spatial history of the city provided the basis to identify certain characteristics of change in the city through a long time span, in particular with regards to the nature and functioning of the street network (presented here) and to the location of specific land uses at certain points in time (Geddes and Charalambous 2017).

The centrality of cities has been shown to be a process (Hillier 1999) and it is certainly not surprising that in Limassol this has shifted over time to 'relocate' to a more geographically central area characterised by higher accessibility. The decrease in the extent of the multi-scale core was also to be expected as this is in line with previous research showing that global accessibility and legibility tend to decrease over time as the city-system grows, and that this is the case for many Mediterranean port cities that have grown rapidly in recent years (Shpuza 2009).

The configurational analysis highlighted two key problematic patterns which were validated by the qualitative analysis:

- The domination of the foreground structure over the background one, which is validated by literature and experts' observations that the city developed radially and with a 'fan-shaped' pattern causing commercial uses to be dispersed along major roads;
- A lack of subcenters which have the spatial potential to sustain local activity, which is validated by experts' comments that attention needs to be given to local neighborhoods, that local public spaces were never constructed and that a concentration of commercial uses was directed towards the center and vehicular roads.

The widespread feeling about the recent development boom in Limassol is highly positive. The redevelopment of the promenade is seen as particularly successful and regeneration efforts are generally being viewed favorably, especially with regards to the historical center becoming lively again. The Marina and the regeneration of the old port are also seen as positive interventions yet are also fraught with reservations and discontent about their design.

The discrete benefits of developing the narrative were that it described the wider context within which the case study is set and gave an historical overview of Limassol's development from a variety of viewpoints. Furthermore, the various tools used to build a narrative provided information where more objective data gathering was not possible or viable. However, the narrative was itself a useful tool because it revealed different perceptions of the city and different interpretations of its development.

The spatial history was clearly able to pick out a variety of problems in the functioning of the contemporary city, highlighting how these relate to the impact of growth, the nature of the expanding street network and recent interventions in the urban fabric. However, identifying the causal factors of such growth, aside of the specific spatial relations of various physical elements of the city, would not have been possible solely through quantitative analysis. Many of the characteristics and processes identified through the configurational analysis could only be contextualized through the historical narrative and verified through the interviews with expert stakeholders. In particular, the various global and local scales of causality which initiated specific phenomena of growth and development could only be identified through the narrative. On the one hand, at the global scale, is the impact of international relations and world economic changes on urbanization, population influx into the city and location of residential development; on the other hand, at the local level, is national economic resources and needs, planning legislation and policy, as well as corporate and individual private interests in real estate. The interaction of macro-level political processes with specific physical and human components, the destabilizing events of conflict interacting with other destabilizing processes of shifting land values, the national and local level planning policies, and the micro-level properties of the street network and the built fabric all conjointly led the specific form of the city.

These findings point to the fact that stark dichotomies between critical views of structural factors and the historical process being the fundamental causal determinants of urban characteristics, or, at the other end of the spectrum, the bottom-up view that urban form is shaped by everyday life and routine activities, is perhaps neither useful for the understanding of form and functioning, nor for the identification of causal factors. Using a broad framework, informed by assemblage theory, can be more productive in revealing the complexities of causal pathways. This has provided us with the ability to identify when and where structural properties and the temporal aspect influence city form. It allowed us to understand and interpret how human and physical components are connected together and it enabled us to identify the scales at which causality is initiated and mediated.

The narrative provided a baseline for reading, interpreting, validating and making inferences about the findings from quantitative analyses. Without the implementation of a comprehensive framework to understand the relationality of the city, it would have been impossible to empirically verify the existence of problems and developmental characteristics and processes identified solely through the application of an individual approach. The framework was key in understanding the contemporary socio-physical identity of the city and what caused this identity, as well as informing the identification of issues, potentials and priorities which can aid planning.

References

- Baker ARH (2003) *Geography and history: bridging the divide*. Cambridge: Cambridge University Press.
- Batty M (2013) *The new science of cities*. MIT Press.
- Bettencourt MA (2013) *The kind of problem a city is*. SFI Working Paper 201-03-008. Santa Fe Institute.
- Bevan R (2014) What makes a city a city - And does it really matter anyway? *The Guardian*. [8 May 2014].
- Booth C (1897) *Life and labour of the people in London*. 3rd Edition. Vol. I-XVII. London: Macmillan.
- Charalambous N (2018) Spatial forms of ethnic coexistence in Ottoman Cyprus: the role of urban form in patterns of everyday life. *Journal of Urban History*. Doi: 10.1177/0096144218816652.
- Charalambous N, Geddes I (2015) Making spatial sense of historical social data. *Journal of Space Syntax* 6(1): 81-101.
- Charalambous N, Zafer Cömert N, Geddes I (2019) The study of urban form in Cyprus. *Urban Morphology* 23(1): 69-82.
- Charavgi (1979a) *Επίλυση των προβλημάτων της πόλης ζητά η συντονιστική επιτροπή Λεμεσού*. [The Limassol steering committee is seeking to resolve the city's problems]. [25 March 1979].
- Charavgi (1979b) *Οι απαντήσεις υπουργών για τα προβλήματα της Λεμεσού*. [Ministers' answers to the problems of Limassol]. [27 March 1979].
- DeLanda M (2006) *A new philosophy of society: assemblage theory and social complexity*. London: Continuum.
- Geddes I (2019) *Validating and interpreting quantitative diachronic analysis through historical narrative: the case of Limassol*. Forthcoming.
- Geddes I, Charalambous N (2017) Building a timeline, developing a narrative: visualising fringe belt formation alongside street network development. In *24th ISUF Conference: City and Territory in the Globalization Age, Valencia, Spain, 27-29 September 2017*, 923-933. València: Universitat Politècnica de València.
- Griffiths S (2012) The use of space syntax in historical research: current practice and future possibilities. In *8th International Space Syntax Symposium (ed M Green, J Reyes, A Castro), Santiago de Chile, Chile, 3-6 January 2012*, 8193:1-26. Santiago de Chile: PUC.
- Hillier B (1996) *Space is the machine: a configurational theory of architecture*. Cambridge: Cambridge University Press.

- Hillier B (1999) Centrality as a process: accounting for attraction inequalities in deformed grids. *Urban Design International* 4(3-4): 107-27.
- Hillier B (2002) A theory of the city as object: or how spatial laws mediate the social construction of urban space. *Urban Design International* 7(3-4): 153-79.
- Hillier B (2012) The city as a socio-technical system: a spatial reformulation in the light of the levels problem and the parallel problem. *Communications in Computer and Information Science* 242: 24-48.
- Hillier B, Hanson J (1984) *The social logic of space*. Cambridge: Cambridge University Press.
- Hillier B, Iida S (2005) Network effects and psychological effects: a theory of urban movement. In *5th International Space Syntax Symposium, Delft, Netherlands, 13-17 June 2005*, 553-564. Delft: Faculty of Architecture, TU Delft.
- Hillier B, Vaughan L (2007) The city as one thing. *Progress in Planning* 67(3): 205-30.
- Hillier B, Yang T, Turner A (2012) Normalising least angle choice in depthmap and how it opens up new perspectives on the global and local analysis of city space. *Journal of Space Syntax* 3(2): 155-93.
- Kritioti M (1988) *Limassol, a town in transition*. MSc Thesis. London: University College London.
- Kropf K (2009) Aspects of urban form. *Urban Morphology* 13(2): 105-20.
- Latour B (2005) *Reassembling the social: an introduction to actor-network-theory*. Oxford: Oxford University Press.
- Lefebvre H (1991) *The production of space*. Oxford: Blackwell Publishing.
- Levy A (1999) Urban morphology and the problem of the modern urban fabric: some questions for research. *Urban Morphology* 3(2): 79-85.
- Lianou M, Christofinis A (2016). *Λεμεσός μετά την ανάπτυξη*. [Limassol after development]. Limassol: ANBAU Christofinis Architects.
- Logan JR, Molotch H (2007) *Urban fortunes: the political economy of place*. USA: University of California Press.
- Maloutas T, Souliotis N (2015) *Living with diversity*. Policy Brief 4 of DIVERCITIES Project.
- Mangoian L, Mangoian HA (1947) *The island of Cyprus. An illustrated guide and handbook*. Nicosia: Mangoian Bros.
- Marcus L, Colding J (2011) Towards a spatial morphology of urban social-ecological systems. In *18th ISUF Conference, Montréal, Canada, 26-29 August 2011*. Montréal: Concordia University.
- McGrath B, Shane G (2012) Introduction: metropolis, megalopolis and metacity. In *The SAGE Handbook of Architectural Theory*, CG Crysler, S Cairns, H Heynen (Eds), 641-656. NY: Sage Publications.
- Nagel Publishers (1974) *Cyprus. Nagel's encyclopedia-guide*. Fourth. Geneva: Nagel Publishers.
- Oliveira V (2016) *Urban morphology. An introduction to the study of the physical form of cities*. Switzerland: Springer.
- Oliveira V, Pinho P, Batista L, Patatas T, Monteiro C (2014) *Our common future in urban morphology*. Porto: FEUP.
- Pilavakis C (1977) *Η Λεμεσός σε άλλους καιρούς*. [Limassol at other times]. Limassol: Onisilos Publications.
- Rakoczy A (2007) *Living*. Cyprus Mail. [24 June 2007].
- Scheer B (2016) The epistemology of urban morphology. *Urban Morphology* 20(1): 5-17.
- Seamon D (2015) Understanding place holistically: cities, synergistic relationality, and

- space syntax. *Journal of Space Syntax* 6(1): 19-33.
- Serghides C (2012) *Lemesos Oinopoleos Metoma*. Nicosia: Afi and Christakis Serghides.
- Severis RC (2006) *Monuments and memories. Limassol, a town of visionaries*. Nicosia: Hellenic Bank.
- Shpuza E (2009) Evolution of street networks in Adriatic and Ionian coastal cities. In 7th *International Space Syntax Symposium, Stockholm, Sweden, 8-11 June 2009*, 101:1-15. Stockholm: KTH.
- Simerini (1988) *Δεκάδες προβλήματα στην Λεμεσό*. [Dozens of problems in Limassol]. [15 February 1988].
- Simmel G (2004) The stranger. In *Urban Culture: Critical Concepts in Literary and Cultural Studies*, C Jenks C (Ed), 73-77. London and New York: Routledge.
- Tonkiss F (2005) *Space, the city and social theory: social relations and urban forms*. Oxford: Polity Press.
- Turner W (1820) *Journal of a tour in the levant II*. London: Murray.
- Versluis L (2013) Towards a multi-scale description of choice. In 9th *International Space Syntax Symposium, Seoul, Korea, 31 October - 3 November, 2013*, 063:1-9. Seoul: Sejong University Press.
- Wacquant L (2008) *Urban outcasts: a comparative sociology of advanced marginality*. Cambridge: Polity Press.
- Whitehand JWR (2001) British urban morphology: the Conzenian tradition. *Urban Morphology* 5(2):103-109.
- Zhang Y (2015) Morphologue: the Bartlett urban morphology group workshop. *Urban Morphology* 19(2): 167-68.

