Rethinking Ostia : a spatial enquiry into the urban society of Rome's imperial port-town

Stöger, J.J.

3 – Space Syntax and Archaeology

This chapter introduces the main principles of Space Syntax, its theory and methods, with the intention of providing the conceptual framework for the spatial approach followed by this study. Space Syntax has enjoyed a lasting, steadily growing popularity within archaeology, reflecting and responding to the 'spatial turn' in social science. Within the domain of Space Syntax, archaeology and its research interest in humans and their spatial framework did not remain unnoticed. In the eyes of Space Syntax archaeology holds an exceptional position within the humanities since it is more concerned with 'real space' than all the other disciplines within the social sciences. Space Syntax perceives archaeology as an inherently spatial discipline, with an interest in space deeply rooted in archaeological traditions and constantly renewed through archaeological practice.[1]

Before introducing the methods and theories of Space Syntax, some earlier thoughts on the relationship between society and the built environment will be addressed. This is followed by a brief review of the links between structuralism and Space Syntax. Next, Space Syntax's own theoretical domain will be described, as well as its methodological framework. Finally, a short summary of archaeological studies applying Space Syntax will be presented.

3.1 THE RELATIONSHIP BETWEEN SOCIETY AND THE BUILT ENVIRONMENT

Academic interest in built space and an anthropological awareness of its significance developed already in the 19th century, when theories of cultural evolution were first formalised. Ever since then, the question about the nature of the relationship between society and the built environment has remained a persistent issue.[2] Over the years the discussion on built space has assigned varying degrees of importance either to the role of the individual or the social context. Explanations ranging from environmental determinism via ecological factors to social evolution have been made use of to describe or to explain how and why people live as they do, or lived as they did in the past.[3] The relationship between society and the built environment has been conceptualised by using a range of formulations: accommodation, adaptation, expression, presentation, and more recently production, reproduction and configuration.[4] Each represents a distinct theoretical perspective and is concerned with its own set of questions. However, despite their diverging approaches most theories agree that from the way people construct, organise and even furnish their living space, inferences can be made regarding the social, cultural, political or symbolic structures which had been informing the spatial responses or choices.[5]

3.2 SPACE SYNTAX AND STRUCTURALISM

The theoretical basis for Space Syntax is partly rooted within structuralism, one of the most consistently developed theoretical approaches which have been adopted in the symbolic analysis of the built environment. Symbolic approaches understand the built environment as an expression of culturally shared mental structures and processes. Hence symbolic explanations often rest on demonstrating how the built environment corresponds to ideal

1. See Hillier (2008a: 223).

2. See Lawrence and Low (1990) for a critical review of research areas, theoretical approaches and literature contributing to the debate on human building activity and society.
3. Cutting (2003: 1-2).
4. Lawrence and Low (1990: 454).
5. Cutting (2003, 3); see also Lawrence and Low (1990: 454).

conceptions of social, political and religious life.[6] Structuralist approaches in particular postulate the existence of an underlying unconscious mental structure combined of binary oppositions that represent universal characteristics of human thought.[7] According to structuralist theory, these unconscious mental structures have the power to generate patterned cultural behaviour. Moreover, the capacity to form patterns is also imparted to space.[8] Space Syntax includes the pattern of spatial inclusion and exclusion into its theoretical framework. However, although Hillier and Hanson agree with the principal ordering aspects of structuralist theories, they recognise other flaws within these approaches to space. They dismiss structuralist anthropologists as being predominantly concerned with 'obvious' cases where a built environment can be identified almost as a projective representation of the social structure of society.[9] Furthermore they disapprove of structuralists for studying space as an external projection of social and mental processes and therefore turning space into a 'by-product of something else and not in itself', which denies space its autonomy.[10]

From these points of critique Hillier and Hanson take the discussion to the level of their own theory building, specifying the requirements a theory of space needs to fulfil: first of all it needs to establish a descriptive autonomy for space. That means spatial patterns must be described and analysed in their own terms prior to any assumption. Furthermore, the theory should account for wide and fundamental variations in morphological type. Finally, a suitable theory must explain basic differences in the ways space fits into the rest of the social system. Hillier and Hanson assert that a theory needs to be open and flexible enough to describe not only systems with fundamental morphological divergences, but also systems which vary from non-order to order, and from non-meaning to meaning.[11] Having set out the parameters required for a suitable theory, Hillier and Hanson devise their own conceptual framework, formulated as the 'Social Logic of Space'. The complete approach is known as Space Syntax and combines theory and method directly concerned with the relationship between society and its architectural and urban forms.

3.3 SPACE SYNTAX'S THEORETICAL FRAMEWORK

Space Syntax takes its starting point from two formal ideas which try to reflect both the objectivity of space and our intuitive engagement with it:[12] space is considered to be an intrinsic aspect of all human activity, and human space is not about the properties of individual space, but the 'configuration of space'. The latter is a concept specific to Space Syntax stressing the simultaneously existing relations of discrete units or parts which make up the whole layout of space of a building or a city. The configuration of space is the means by which space acquires social significance and has social consequences. Depending on the point of view within the layout, the spatial configurations of any building or settlement changes accordingly. Thus, the way in which spaces are linked together affects how people move through and use those spaces.[13] Within any configuration the constituent spaces can be integrated or segregated, depending on the degree to which one must pass through other spaces to go from a particular space to all others.

The social implications of a spatial configuration might best be explained using Bafta's example of boundaries.[14] He reminds us that boundaries create specific spatial relationships of access or visibility among the component spaces; in return these spaces

6. Lawrence and Low (1990: 466); Rykwert (1964) and the much earlier work by Fustel de Coulange (1874) relate to the city as a reflection of religious beliefs, whereby all aspects of city life were dictated by respect for the sanctity of the city, see Fustel del Coulange (1956: 11, 127).
7. First and foremost Levi-Strauss (1963); see Lawrence and Low (1990: 467) for an overview of the theoretical development and various influences.
8. Lawrence and Low (1990: 468); Hillier and Hanson (1984: 5).
9. A 'textbook' example would be a chiefdom society with clearly distinct dwellings according to social rank.
10. Hillier and Hanson (1984: 5).
11. Hillier and Hanson (1984: 5).
12. See Hillier and Vaughan (2007: 207) for an introduction to Space Syntax written for a social science audience.
13. Cutting (2003: 3).
14. Bafta (2003: 18).

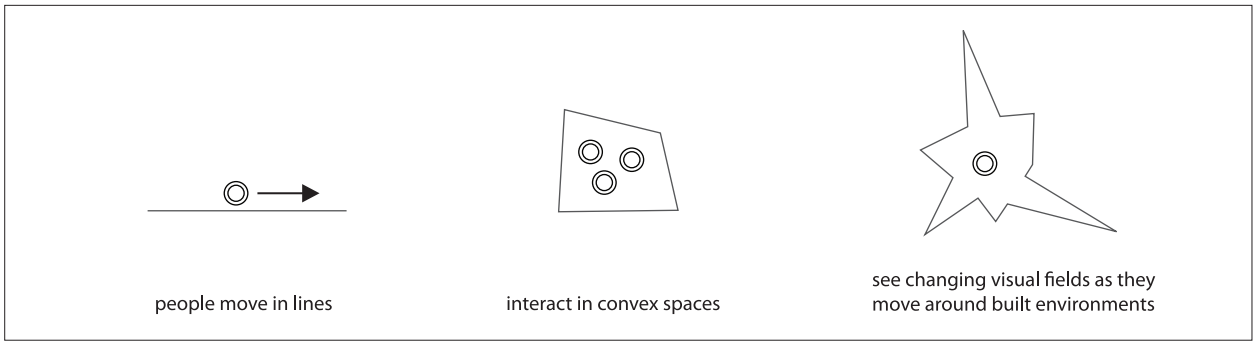

Fig. 3.1 – The ' Human Geometry of Space Syntax': moving through space, interacting with people, or just seeing ambient space, all having a natural and necessary geometry (source Hillier and Vaughan 2007)

generate patterns of movement and encounter. Thus boundaries have an effect on both society and spatial configuration. He adds that certain spatial components within the configuration will offer a higher rate of unplanned encounter (integrated spaces) and others a higher rate of privacy (segregated spaces). Bafta contends that the spatial privileges held by certain members of society, and denied to others, create and maintain levels of social hierarchy and control. Hence built space not only passively expresses social processes but actively directs and shapes those activities which are concerned with social interaction and with controlling behaviour in host-guest or insider-outsider relations.[15] Thus the configuration of inhabited space has a fundamentally social logic, and at the same time social structure is inherently spatial.[16]

3.3.1 Concepts and techniques of Space Syntax

Space Syntax is a collective term for theoretical and analytical techniques to identify, compare, and interpret patterns of spatial configuration. It was pioneered by the architectural and urban morphologists Bill Hillier and Julienne Hanson in the late 1970s and further developed by them and their colleagues at the Bartlett School of Architecture at University College London.

Initially theory and techniques were conceived as planning tools to help architects to simulate the likely social effects of their designs. Space Syntax has been extensively applied in the fields of architecture, urban design, planning, transportation and interior design. Over the past decades, Space Syntax techniques have also been used for research in fields as diverse as anthropology, information technology, urban and human geography, and archaeology.

Just as theory and techniques have been inseparably intertwined from the very beginning, the study of space manifests itself through worked application. From its start the objective of Space Syntax has been to develop strategies of description for configured spaces, ranging from individual buildings, via built complexes to small-scale and large-scale settlements, in such a way that their underlying social structure can be exposed.[17]

Space Syntax regards all human activity as being anchored in spatial geometry (Fig. 3.1): movement is linear, interaction requires a convex space in which all points can see all others, and from any point in space we see a variably shaped visual field, called an *Isovist*.[18] Accordingly Space Syntax's quantitative techniques include axial line analysis, convex spatial analysis and convex *Isovist* analysis. The key to such a description and subsequent analysis was the recognition that the sociologically relevant aspects of configured space can be captured at the level of topological description and represented

15. Lawrence and Low (1990: 470-471).
16. Bafna (2003: 18).
17. Bafna (2003: 18).
18. Hillier and Vaughan (2007: 207).

by way of graphs.[19] The topological description reflects the patterns of accessibility present within spatial systems (building and/or settlement); in other words this is how the arrangement of spatial units and entrances control access and movement.[20] With regard to settlement systems this refers to distributed (more than one point of control) and non-distributed (only one point of control) relations within the parts constituting the settlement.[21] For both buildings and larger spatial settings, Space Syntax distinguishes between symmetry and asymmetry: symmetry exists between spaces that have direct access to other spaces, while asymmetric spaces are those which have to pass through one or more intermediary spaces.[22] These characteristics can be identified, qualified and quantified by means of different graph techniques.

3.3.2 Space Syntax graphs and diagrams

Convex maps together with the derived Access Analysis are among the most applied means of describing and examining spatial configuration within Space Syntax studies.[23] Access Analysis is of special interest to archaeologists since it has proved to be useful in studying the social use of domestic and small settlement spaces.[24] Access Analysis identifies patterns of potential movement and non-movement within spatial configurations to identify the crossing points between the two and give social significance to these statistical values. Access Analysis employs as its basic unit the convex space, which is not formally delineated but intuitively defined as a space within which all parts are visible.[25] One convex space will be linked to another, constituting a subdivided spatial configuration. Based on this configuration a graph can be constructed marking each convex space with a node and each accessible connection between spaces with a link. Subsequently the degrees of control and access between all spaces comprising the configuration can be identified, visualised, calculated and evaluated in terms of its potential social meaning.

In order to move away from a static representation of space, Space Syntax has been exploring ways to gauge the dynamics of movement and the potential for unplanned or unforced interaction and encounters within spatial settings. These spatial properties are best captured by linear or axial maps which are overlaid on top of the convex map. The researcher lays down the longest straight line that passes through at least one permeable threshold between two adjacent convex spaces; this process is repeated until all adjacent convex spaces have been crossed. The resulting network of intersecting straight lines represents the axial map. Initially developed to describe urban areas, its simplicity has made the axial map the preferred method for studies focussed on movement within any spatial settings. Originally the method was based on a notional understanding that the line of sight is the first organising and unifying device in spatial experience, and secondly, the number of distinct turns on a route was found to be more crucial to spatial experience than the actual distance covered;[26] this means that people on their routes avoid turns and would rather walk a longer distance than take too many directional changes, even is this would prove to be metrically shorter.

Space Syntax research has been continuously developing new analytical possibilities, converting these initial notions into solid statistical evidence. By comparing visual integration values with observed movement, a strong statistical correlation between the visual field structure and route path selection was established, implying that movement follows visual lines rather than other attraction powers.[27] Regarding the frequency of turns on a route interesting insights have been achieved by correlating observed movement patterns with results from axial analysis. Contrary to the common assumption that route selection simply relies on minimizing distance, these studies established that the observed movement patterns tend

19. Bafna (2003: 18-21).
20. Hillier and Hanson (1984: 14).
21. Hillier and Hanson (1984: 11-14).
22. Hillier and Hanson (1984: 11)
23. See Bafna (2003: 21-25) for a comprehensive introduction to Space Syntax analytical techniques, which has been largely followed in this section.
24. See Cutting (2003) for a critical survey of Space Syntax techniques applied to prehistoric settlement architecture.
25. Bafna (2003: 23).
26. Bafna (2003: 23-24).
27. Hillier and Vaughan (2007), see also Conroy Dalton (2003).

to avoid turns at acute angles, opt for the least turns, and only in third place select the shortest paths.[28] Bringing these findings to light opens new and better ways of guiding movement within cities, and offers new opportunities for improving existing traffic patterns. Unfortunately, the past built environment and the street networks of archaeological sites do not allow for real time movement analysis and the study of observed pedestrian flows. Nevertheless, some of the simulation tools offered by Space Syntax can help to model predicted pedestrian flows and movement within ancient cities to reach a better understanding of the past spatial experience.

The choice between using a convex map or an axial map for describing the spatial configuration depends on the questions being asked. If the analysis is used to discuss the arrangement of functional spaces within buildings or generative types of buildings within settlements then convex maps seem more suitable. If the analysis is focussed on the understanding of behavioural characteristics of the spatial setting, axial maps seem more useful.[29] Above all, axial maps prove very fitting for analysing the ratio of integration or segregation within urban settings, the so-called "RRA" (*real relative asymmetry*), already mentioned.[30] The RRA is calculated for each space, or each axial line of the entire system in relation to all other spaces.[31] In operational terms, integration represents the average depth of the spatial unit from all other spatial units within a given system, and hence its value is affected by the entire spatial configuration. Within Space Syntax analysis RRA ratios predict the 'global' structure of a spatial system. In terms of analysing 'local' properties, Space Syntax often resorts to calculating the connectivity of a system, which is defined for each spatial unit in relation to the number of spatial units directly connected to it. Other descriptions of local properties include integration up to a small radius, limited to all spatial units within a given depth from the unit analysed (e.g. radius 3 or 5). Space Syntax uses the degree of correlation between connectivity and integration values as a measure of predictability built into the entire spatial environment. It therefore is understood as a measure of the intelligibility of a configured space.[32] These methods result from recent developments within Space Syntax with a new emphasis on spatial cognition and thus are mostly applied within urban planning.

3.4 SPACE SYNTAX AND THE CITY

In the light of today's global urbanisation with ever sprawling mega-cities and urban population outnumbering rural population for the first time in global history,[33] Space Syntax's contributions to a better understanding of urban complexity are of the utmost significance. As outlined above, the aim of Space Syntax is to develop strategies for spatial analysis in such a way as to reveal the underlying social structure. This allows for secondary theories to develop and above all for practical solutions to be found regarding the effects, including adverse effects, of spatial properties on various social or cultural variables.[34] In response to pressing urban problems an increasing number of Space Syntax studies have been directed towards social issues. These are as diverse as mapping the spatial forms of poverty, analysing social segregation and deprivation within spatial systems, as well as studying crime rates and their association with urban topography.[35] Again, other studies are primarily concerned with the economic aspects of space, thus pursuing a more traditional application of Space Syntax.[36]

With reference to urban history and archaeology, Space Syntax studies concerning formative urban processes are of specific interest. By examining the axial maps of a large corpus of city plans, including historical cities, Hillier and colleagues established

28 Hillier and Vaughan (2007).
29. Bafna (2003: 25).
30. For information on RRA see Chapter Four on Space Syntax techniques, and see also section 2.5.5 above on RRA applied in the spatial assessment of Empurias (Kaiser 2000). See also section 2.4.3 in this study on Laurence's Space Syntax approach applied to measure the integration ratios between houses and streets; see Laurence (2007: 127-129).
31. Hillier and Hanson (1984: 108-111).
32. Bafna (2003: 26-27).
33. Mackenzie (2007: 49).
34. Bafna (2003: 18).
35. Some examples are: Vaughan (2007) and Nubani and Winemann 2007.
36. Hillier and Penn *et al*. (1993).

that, despite strong cultural variations in different regions of the world, there are also powerful phenomena shared by most cities regardless of cultural or geographic determinants. These findings postulate a 'common language of cities' from which Space Syntax hopes to build a domain theory for the study of built environments as structural and functional entities. Space Syntax is concerned with the problem of how both cultural variations and invariants can arise from the spatial processes that generate cities. In their pursuit of answers, Hillier and colleagues have outlined a generic process by which spatial configurations, through their effect on movement, first shape, and then are shaped by, land-use patterns and densities. Collectively these finding have led to the formulation of wider theoretical concepts, such as the 'Cities as Movement Economies',[37] and 'Centrality as Process'.[38] Comparative studies of axial maps identify movement as a strong force holding the urban system together, with basic patterns of movement generated by the urban grid itself. Thus the urban grid surfaces as a core urban element which, in spite of its static nature, influences the long-term dynamics of the whole urban system.[39]

Another similarity, which emerged from Space Syntax's comparative analyses of axial city maps is the phenomenon of the so-called 'deformed wheel'. It is characterised by streets which appear like spokes leading in all main directions. The deformed wheel is part of a generic structure of cities that is required to move people into and out of the centre, with quieter residential areas in the interstices of the radial routes of the wheel. This generic pattern was first identified as a deep structure common to many small towns, seeming to occur regardless of topographic differences. As a global pattern the deformed wheel is also found remarkably well in larger cities. Even in mega-cities such as London and Tokyo (which is the largest system ever analysed by Space Syntax), a notable and even more complex version of the wheel is found.[40] Interesting enough, it also emerges in a city under the influence of at least two cultures, as the axial map of Nicosia in Cyprus demonstrates. The differences between the Greek and the Turkish area are clearly visible in the texture of the grid and reflect typical distinctions found between town-planning systems in Europe and in the Islamic world. Still, a typical deformed wheel pattern is evident on top of the geometric differences and the variant degree of integration.[41] The deformed wheel also appears in the axial map of Pompeii.[42] Hillier and colleagues understand the pattern of the deformed wheel as a way to counteract the natural tendency for urban centres to become segregated as the city grows around them, by linking centres to edges, and so accessing visitors to the heart of the system and inhabitants to the edges.[43] The deformity occurs as the long-distance arteries deviate around burgeoning suburbs.

The impressive empirical record of comparative urban studies conducted by Space Syntax research offers a wealth of knowledge, available as guidelines, and a source of inspiration for historical or archaeological research. Needless to say, past urban environments differ from today's inhabited urban space. Ancient cities studied from maps and archaeology appear incomplete and fragmented and have their own set of problems. On the other hand, because of the limited evidence available, archaeology has to make the most of its data and can benefit from incorporating aspects of Space Syntax into the study of ancient urban space.

3.5 SPACE SYNTAX IN ARCHAEOLOGICAL STUDIES

Space Syntax has enjoyed a lasting, steadily growing popularity among archaeologists for the past 25 years. Most of the published and probably even more of the unpublished work has been undertaken at postgraduate level.[44] Early criticism was stridently expressed by Leach,[45] his voice still echoing through a number of ethnographic and anthropological, as

37. Hillier and Penn *et al* (1993) and Hillier (2007).
38. Hillier (1999) and Hillier (2009: 16-35).
39. Hillier (2001: 02.2)
40. Hillier (2001: 02.8)
41. Hillier (2001: 02.9)
42. Fridell Anter and Weilguni (2003: 34).
43. Hillier (2007).
44. See Thaler (2005) for a succinct summary of space syntax studies in archaeology.
45. Leach (1978).

well as archaeological, studies.[46] However, more usually, promoting a pragmatic attitude, archaeology has developed a certain tool box approach towards Space Syntax. Archaeologists often feel the need to explore an additional or a completely new aspect of their research, or simply add a spatial component to an otherwise material culture-driven research agenda. Space Syntax provides tools to think with and offers analytical techniques which are relatively user-friendly. In additions, toolbox approaches seem to have had beneficial effects for archaeological applications since they encourage conscious efforts to integrate Space Syntax with other potentially complementary perspectives.

As a result, a number of archaeological studies incorporate selected aspects of Space Syntax into research with a wider focus, e.g. Fairclough's analysis of historical space in complex high status medieval buildings,[47] or Gilchrist's study of gender domains.[48] Within the field of Classical Archaeology, unsurprisingly, Pompeii has turned into the most syntactically examined site. Laurence's work, already discussed above, studies activity levels in Pompeian streets through the relationship between streets and houses, using only limited aspects of Space Syntax analysis.[49] Fridell Anter and Weilguni apply axial line analysis to Pompeii's street network,[50] while Newsome assesses changing circulation patterns around a specific city block.[51] Van Nes, being an urban planner and not an archaeologist, introduces not only new analysis tools but also a new focus: Pompeii's 'urban plinth', adding statistical data from micro- and macro-scale spatial analyses and agent-based modelling. Van Nes' approach examines the intensity of movement in relation to land-use, and compares the data established for the Roman city to socio-economic empirical knowledge from today's urban contexts.[52]

In contrast, Grahame's syntactical assessment of Pompeii's domestic architecture focuses more narrowly on the tenets of Space Syntax.[53] Anderson's approach,[54] quite the opposite, argues for an adapted version of Space Syntax to identify functional patterns within Pompeii's domestic architecture. DeLaine's pioneer work brings Space Syntax to Ostia; while her early work is concerned with the resident/visitor relation of domestic architecture, her more recent work focuses on Ostia's *medianum* apartments, using Access Analysis to investigate the organisation of space within the apartments and their relation to the outside to reach a better understanding of the occupiers and the socio-economic group they belong to.[55] Kaiser, as discussed above, applied selected analysis tools to the urban environment of Empurias.[56]

Benech integrates an adapted version of Access Analysis into a wider study of domestic dwelling-units at Doura-Europos.[57] He applies Access Analysis to geophysical maps, and subsequently compares and confirms his results with outcomes achieved from fully excavated dwelling-units and thus demonstrates the usefulness of Space Syntax approaches for the interpretations of residential space based on geophysical maps. Staying in the region but moving up in time Chatford Clark applies selected Space Syntax techniques (visibility graph analysis and Isovist studies) to Byzantine churches in Jordan to explore local and regional stylistic variation through the organisation of liturgical space and the placement of liturgical installations.[58] Space Syntax techniques were able to highlight some of the visual patterns possibly experienced by the assembly members with reference to accessibility and visibility.

Brusasco's study of Mesopotamian domestic architecture combines spatial and textual evidence.[59] Thaler integrates Access Analysis within a study

46. Van Krimpen-Winckel (2009).
47. Fairclough (1992).
48. Gilchrist (1988).
49. Laurence (2007), see also Chapter Two of this study for a review of Laurence's work.
50. Fridell Anter and Weilguni (2003).
51. Newsome (2009: 124-125).
52. Van Nes (2009).
53. Laurence (1994, 2007); Grahame (2000); see Chapter Two above.
54. Anderson (2004).
55. DeLaine (2000; 2004).
56. Kaiser (2000).
57. Benech (2007).
58. Chatford Clark (2007).
59. Brusasco (2004; 2007).

of a wider perspective examining the architectural changes at the Late Bronze Age palace of Pylos at two successive points in time.[60] Thaler's results challenge the widely accepted narrative which ascribes changes in the palace architecture to a long-lasting economic decline. The results of his analysis point to a continuous adaptation to functional needs compatible with a still expanding polity. Letesson's study (Late Bronze Age Crete, c.1600-1425 BC) used syntactical methods to analyse Cretan Neopalatial architecture. The study identified a large number of topological and quantitative recurrences within the Minoan architectural landscape.[61] Paliou's research combines an autonomous agent approach and Space Syntax concepts to investigate the Theran Murals of LBA Akrotiri (Thera, Greece). Her study is concerned with intra-site movement and visibility from public space.[62]

Fisher employs syntactical tools in his research into Bronze Age settlements on Cyprus. His case study focused on Enkomi, examining the Ashlar Buildings to shed light on the use of architectural design and embellishment by Late Cypriot elites to express power.[63] Lang's study applied Space Syntax to Archaic Greek houses to investigate structural changes concerning the subdivision in the house layouts. Lang's analysis revealed that in the Early Iron Age most of the rooms in houses were arranged in a linear series, while Archaic houses had a more radial structure with rooms grouped around a central space.[64] Westgate applied a similar analysis to Hellenistic houses from Crete with interesting results regarding the centralising function of courtyards within the houses' spatial organisation.[65] Bintliff has recently integrated these and other space structure studies of ancient Greek housing to illuminate the long-term social and economic trends in ancient Greek society.[66]

Space Syntax also proved to be useful in a number of ethnographic studies. Widlok's study integrates Access Analysis into a broader study of settlements to correlate between social and spatial form.[67] Dawson uses Access Analysis to examine the spatial structure of past Inuit snow houses based on ethnographic records. The results demonstrate that variation in family structure and kinship systems are reflected in the spatial configuration of snow house architecture.[68] A large range of excellent Space Syntax studies have been developed by researchers investigating Native American sites. Ferguson's research into historic Zuni architecture combines the results of the syntactical analysis of Zuni Pueblos with a rich ethno-historic and ethnographic record.[69] Stone's analysis of settlements in the Point of Pine Region of Arizona,[70] as well as Van Dyke's syntactical examination of outlying Chacoan great houses brought surprising results concerning the spatial patterning. Van Dyke's analysis incorporated room function and pueblo layout, and finally these houses could be understood as a group of separate but equal household units accessible primarily through the roof and plaza.[71] Shapiro's work shows how the application of syntactical tools can help the archaeologist in 'discerning unobservable changes in social organisation from observed changes in the spatial configuration of prehistoric settlements' (Arroyo Hondo Pueblo, near Santa Fe, New Mexico).[72]

A few examples of studies focused on Medieval and modern periods should be mentioned. An interdisciplinary cross-cultural study of urban housing in Switzerland took a critical stance to Space Syntax emphasising a range of tacit and explicit regulatory factors that ought to be considered and are not represented in the 'mere act of transforming the two-dimensional representation of a building to a graph'.[73] Craane's use of Space Syntax promoted

60. Thaler (2005).
61. Letesson (2009)
62. Paliou (2008).
63. Fisher (2006).
64. Lang (2005).
65.Westgate (2007).
66. Bintliff (2010).
67. Widlock (1999).
68. Dawson (2002).
69. Ferguson (1996).
70. Stone (2000).
71. Van Dyke (1999).
72. Shapiro (1997).
73. Lawrence (1990: 75).

a more positive attitude towards the method:[74] her study of Medieval trade in the Low Countries and commercial space in Dutch cities combines Space Syntax with other methods from urban historical geography (map regression).[75] Karimi's study expanded the scope of comparative urban research towards a more global understanding of cities.[76] Adopting Space Syntax techniques, Karimi investigates the phenomenon of the 'organic city' to shed light on those factors which define 'organic development'. He selected two groups of oriental (Iranian cities built in the Islamic tradition) and occidental cities (English Medieval towns).

Apart from those Space Syntax studies which make full use of the combination of access graphs and statistical values, there are also a number of applications which implement qualitative rather than quantitative Space Syntax analysis. These approaches exploit the descriptive power of access graphs without the calculation of numerical indicators. A good number of archaeological studies were able to offer new insights into the spatial organisation of their area of research by relying on the information inherent in the graph, without the full numerical calculation of spatial values.[77]

The variety of case studies introduced here demonstrates how well-suited Space Syntax tools are to investigate the spatial aspects of any material record from small scale individual dwelling units to larger settlements, and even regional approaches to human movement. Archaeological studies seem to indicate a preference for Access Analysis; this can be easily explained by the nature of the archaeological record and its tradition in meticulous documentation. The production of detailed site plans and individual house plans are often the very focus of archaeological recording. Space Syntax analysis therefore seems the most logical step to infer meaning from those detailed plans.

Almost all of the studies which have been reviewed for this brief summary praise Space Syntax for providing suitable techniques to discern discrete patterns which would not have been available to careful archaeological observation only. Most of the scholars agree that Space Syntax techniques add a level of objectivity which helps to place their research on more solid ground than subjective analysis based on notions of symbolic or functional characterisations could offer.[78] A number of studies also raise concerns about the quality of their data,[79] i.e. incomplete site plans and sample sizes not large enough to reach statistical viability. This is however a general problem related to the fragmentary nature of archaeological data, and should not be used to resist the application of Space Syntax.

74. Craane (2009).
75. Lilly (2000).
76. Karimi (1997).
77. Foster (1989); Bonanno *et al*. (1990); Fairclough (1992) and Cutting (2003).
78. Fairclough (1992: 348).
79. Cutting (2003).