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(in Arabic)

Residential Housing in Gaza: Case study of Tell Elhawa
Moustafa Elfarra & Samar Ghali

A new vision of the philosophy of Dar Al Islam
Djamel Chabane
Vernacular Architecture

Seeking an Approach

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Abstract
Current available research and vernacular studies on domestic space culture have tackled this issue from different perspectives. Some studies have accounted for formal aspects, while others investigated deeper on a form-function level, extracting hidden socio-cultural themes, one of which is Space Syntax theory by Hillier et al. This paper seeks to explore current approaches in search for a methodology to help investigate and extract socio-cultural themes from domestic space organization.

The principal axiom for the whole syntax theory of space: 'spatial organization is a function of the form of social solidarity; and different forms of social solidarity are themselves built on the foundations of a society as both a spatial and a transpatial system'

The social logic of space p 142

1. Introduction
The study of form and function, it seems, within the problematic issue of understanding the paradigm of Islamic architecture as a precedent for contemporary designs, can prove to be elusive, tiresome, and perhaps misleading. This is because Islamic architecture, and architecture in general may be represented by monumental buildings, which are often built for the elite and do not necessarily reflect or represent the prevailing socio-cultural values of the majority. This renders any study in this realm so special and limited within private domain. The study of architecture versus vernacular gains significance, because architects tend to refer to monumental architecture for precedents, hence confusing the issue of the value of extracting real social themes from physical structures and historical precedents,

For this, it seems right to attempt to put things right and try to study and understand the vernacular on a deep level, and to search for a methodology to try to extract meanings and themes that can be defined as precedents for contemporary architects. For this, the vernacular seems suitable for such an investigation. The question is: To what extent have studies in the record been able to extract and retrieve social themes and to understand space, form and function in vernacular architecture?

To answer the question, it seems we need first to review current studies in the record that have accounted for vernacular architecture, then we need to explore those that tackled domestic architecture for its close relation to the vernacular across cultures. Therefore this paper aims to achieve two main goals: First to attempt to search in vernacular architecture investigating how spatial patterns can be extracted from buildings. Secondly, to search for a methodology to test ideas and concepts by scrutinizing current approaches and...
studies to understand the extent to which they can provide useful tools for analysis.

The structure of the paper will be: First to review available studies in the record on domestic vernacular architecture. Second, to explore ideas, which relate form to socio-cultural context, for this we chose a most notable research by Henry Glassie in his 'Folk Houses of Middle Virginia' and will make comparison with ideas by one of the most advocates of heritage, tradition and vernacular architecture in the Arab arena; that is Hassan Fathy's, to understand cultural differences. And third, to review current research and studies on domestic space culture on the Arab house.

1.1 Available studies on vernacular domestic architecture

Research on vernacular architecture has been carried out extensively, worldwide, over the last few decades. The particular interest in such research lies in the methodology by which we can understand form in difference to function within socio-cultural context. Notable examples, where a distinguished methodology is used to shed light on vernacular architecture within the domestic domain, are books such as 'Architecture without architects' by Rudovsky in 1964, or Rapoport's 'House, form and culture' in 1969, the 'Illustrated Handbook of Vernacular Architecture' by Brunskill in 1987, or the 3-volume study by Paul Oliver 'Encyclopedia of Vernacular Architecture of the World' in 1997. Other important studies interested in domestic space have provided no less innovative approaches to explore and understand spatial organization within cultural contexts leaving the door wide open for further research. In this regard, Henry Glassie's 'Folk Houses of Middle Virginia' as well as Julienne Hanson's 'Decoding Homes and Houses' which derives its methodology from Hillier et al's Space Syntax- are among such leading studies in this field. Other studies are found to tackle the issue from a very broad level to a more specific one, as the next review will reveal.

On the general level, Pearson's study (Pearson, 1989) represents an introduction to what he defines as 'natural house', which asserts the integration between the man-made environment and the natural one. He presents cross-cultural forms of houses and the effects of climate in developing certain elements in the house over others. Apart from the interesting introduction to houses in different cultures, the book offers a classification of typology of houses in terms of their effect upon body, mind, and spirit, and the relation with the surrounding ecological system. Moreover, the book investigates the effect of various climatic zones on health and its reflections on the form and the function of the house. In the last part, which tackles the various living spaces within the house, Pearson defines each space in its relation with the orientation of the sun, and in terms of health and harmony within the natural, rather than the man-made environment. Although the research seems comprehensive in relation to various aspects of a healthy house, supported by illustrations from cross-cultural backgrounds, it still remains general and provides little to understand the spatial organization, or form-function relationships rigorously.

Another study on this level is Rudofsky's 'Architecture without Architects' (Rudofsky, 1964: 2) in which he introduces the concept of 'nonpedigreed architecture'. In this study he reads vernacular, indigenous, and rural architecture, and attempts to understand the social structure of the building form in a spiritual framework.

Among studies of the architecture of the primitive house, Rykwert's study tackles the idea of the primitive hut in architectural history. The author investigates shelter since early history and makes analogy with the temple as a spiritual symbol that man has aspired to achieve in the created house. Quoting from Le Corbusier in Vers Une architecture, Rykwert writes: 'Primitive man, has halted his chariot: he has decided that there shall be his home ground. He chooses a clearing and cuts down the trees that crowd it in; he levels the ground about it; he makes a path to the stream or to the settlement of his fellow tribesmen which he has just left, this path is as straight as his tools, the pegs of his tent describe a square, hexagon or octagon: the palisade (of the settlement) forms a rectangle whose four angles are equal, the door of
the hut opens on the axis of the enclosure, and the gate of the enclosure faces the doorway of the hut, look at a drawing of such a hut in a book of archaeology, here is the plan of the house, the plan of a temple' (Rykwert, 1972: 14-15). Starting from this notion of the relation between the need for shelter and spiritual needs, Rykwert projects this idea on a cross-cultural domestic architecture, ranging back to the Romans, Greeks, Egyptians and to modern ideologies such as Communism, and Judaism. The study is replete with analogies and interesting comparisons, hence marking an approach that reflects on deep spiritual meanings within the physical form.

Gardiner's study investigates the evolution of the house since early cave dwellings to the present time (Gardiner, 1975). He highlights climate, as the main factor among others, to shape the house. However, when he turns to the spatial aspects his description is at best narrative, subjective and unsustained with no evidence. He writes, for example: 'The design and construction of such architectural devices as gateways and courts reflect the equally human wish to establish a relationship between outside and inside, and to show that the huge walls behind which man shut himself away - or the central court plans of the Sumerian houses which enclosed him - were not made from choice but from some kind of fear' (Gardiner, 1975: 78). His account on space layout is unclear and superficial; hence his study lacks the analytical perspective.

Other studies like (Hamdi, 1995) introduce the idea of the house as a micro-social entity created by local community. Hamdi's study gives rise to social ideas that Hassan Fathy called for; particularly the idea of self-help, which aims to allow the collective local community to participate in the decision-making and building of their neighbourhood-unit houses and common spaces rather than only the single house. Despite this social approach the study is disappointingly restricted as it does not go beyond the core-unit. Unlike what is expected, it neither succeeded to associate the house with social influences behind its evolution nor to establish a relation with its surroundings as a collective complex based on the social ideas of self help it aimed to establish. In other words, it fails to combine space/function with socio-cultural factors on the micro or the macro levels.

On the evolution of the house, Frescura provides a study that explores the architecture of the house; its form and construction methods in South Africa (Frescura, 1981). The study can be described as partially descriptive as well as analytical with an attempt to refer to influences on the evolution of form with reflections on social meanings for the spatial layouts. Frescura writes: 'The bilabial house represents a highly sophisticated concept in household organization and it takes into account the special relationships which exist between the family's semiprivate and private areas and the settlement's common zones' (Frescura, 1981: 25). However, despite the seemingly superficial and simple scope of the study, the book gives a good investigation of primitive houses in terms of form, function or space, although the descriptive side does not fully integrate with the analytical one.

In a specific study on the evolution of the English house we find Burnett's study of social housing in England from 1819 to 1985 (Burnett, 1978), and Penn's study of English houses -though not in chronological order- that belong to the same period (Penn, 1954). While Burnett looks at houses in relation to the social, political, economic, and cultural factors to give rise to influences behind its evolution, Penn's study explores houses from a different perspective in terms of typology, form, construction material, heating, lighting, cost and finance. While Burnett defines his houses in terms of 'class' by looking at working and lower-middle class houses, Penn's classification lacks any social meaning. Penn's study can at best be a good source for further rigorous study on the English house. Similarly, Burnett's study, despite its 'class' approach, lacks any account of that social impact on the layout of the houses studied, neither at the macro level of the arrangement of the local community, nor at the micro level of the household and the house. Therefore, both studies fail to provide a comprehensive socio-cultural review as to why variations in the layouts of the houses are found. Instead, we find Penn's review giving rise to
issues as a product instead of scrutinizing the process of variations.

Cooper also provided a study on the English houses for the gentry between 1480-1680 (Cooper, 1999). He addresses issues of space-function/interior exterior to understand the relation between the private/public, guests/inhabitants, and social notions of hospitality in relation to the physical layout. The study is interesting and provides a platform to analyze the layout of the house in relation to its social structure. Yet, it can be criticized for being very theoretical with no practical perspective.

Another study on the form of the house is Pidgeon's (Pidgeon, 1960). His study is a cross-cultural review of mainly European and American houses in Finland, Sweden, Denmark, West Germany, Belgium, Holland, Italy, the United Kingdom, Canada, the United States, Mexico, Chile, Australia, and Japan. Although the study is extremely descriptive, it draws a line of similarity between this huge cross-cultural sample in that almost all houses share an open plan; living, dining, and cooking areas that flow freely into one another. It also addresses social issues such as privacy, as well as building materials, different climates and altitudes. The examination of such a huge cross-cultural sample could have been more rich and interesting if taken within a scope of theoretical context. Instead, it is disappointingly descriptive as a review of houses across various cultures and climatic zones.

Oliver's approach is different in 'Dwellings: The House across the World' in 1987 in which he examines dwellings as a process of building and as artifacts. He investigates dwellings from a social perspective as an activity of living, and as a place or structure attempting to understand their forms as nonprofessional primitive artifact. However, the author discusses the idea of primitive architecture as 'the most invidious, and also imprecise, implying either a primitive origin to architecture which the buildings represent, or primitive peoples who build them; traditional architecture is better, for it acknowledges the inheritance of the past. For this reason though, it is applicable to much formal designed architecture. The term which has gained widest acceptance is vernacular architecture with its linguistic comparison to the language of the common people: the folk equivalent of formal architecture, indigenous architecture is perhaps a more accurate term, certainly less metaphoric though it cannot be applied effectively to imported forms and to the buildings of peoples that are not native to a region' (Oliver, 1987: 9). In his investigation of case studies from different cultures, Oliver states that they imply 'a record of responsiveness to altering lifestyle and societies in change' (Oliver, 1987: 10). According to the author, 'there are many factors that affect the nature of dwellings across the world, such as availability of certain materials, or the varying kinds of climate, altitude and environment in which people live, I have chosen to concentrate on certain principles, both environmental and cultural, which shaped the variety of dwelling types, they involve material resources, forms of dwelling, the technologies and processes by which they are built; climatic and environmental considerations; the way the space is organized and used within the dwelling to meet the demands of daily living' (Oliver, 1987: 11). However, despite his investigation of cross-cultural sample of houses, Oliver did not provide a systematic procedure on how to investigate the underlying spatial themes that might reflect cultural habits or lifestyles.

Best known for his leading socio-cultural study of the house, Rapoport considers form as largely determined-object by its culture, whilst other factors that others consider being determinants, he considers mere building form modifiers. He writes: 'My basic hypothesis, then is that house form is not simply the result of physical forces or any single causal factor, but is the consequence of a whole range of socio-cultural factors seen in their broadest terms. I will call the socio-cultural forces primary, and the others secondary or modifying' (Rapoport, 1969: 47). His major concern was the primitive and vernacular buildings and settlements in order to understand the forces that shape these dwellings. The study attempts to look at the variety of house types, forms and the forces that affect them, and to a certain extent to find implicit rather than explicit influences.
In a more recent study, Rapoport addresses space with reference to psychology and behavior. He argues that perceived space may be seen as the total, cognitive construct based on psychological criteria, one of which is subjective space, another aspect of psychological space is experiential or sensory space. This can be visual, acoustic, olfactory, thermal, kinesthetic, or tactile, and the stress on specific sensory modes, and hence on sensory spaces, will vary from culture to culture (Rapoport, 1994: 49). Moreover, Rapoport suggests that space is a central element in understanding inherited cultural values as he defines concepts such as 'space' and 'spatial qualities', which he sees as culturally related and dependent on values and lifestyles. He also suggests that a sample ranging both through time and across cultures is necessary for a thorough understanding of these concepts (Rapoport, 1994: 57).

In studying the 'Pueblo' settlements, a Spanish term used for a large variety of ancient and modern cliff dwellers, Rapoport relates the formation of these primitive communities to an integration between religion, symbolism, and mythology, which are closely linked to social organization and everyday life (Rapoport, 1969-a: 69). Rapoport also suggests that 'even a superficial understanding of these aspects; will greatly help towards an understanding of the pueblo as a form' (Ibid.). Rapoport also introduces rituals and spiritual values as interdependent determinants in the outcome of the physical arrangements of the pueblo's built environment. However, Like Oliver's work, Rapoport's studies provide theoretical framework to explain the formulation of the house as a cultural object, but does not provide a means to retrieve these embedded values within the physical layout in order to detect cross-cultural variations or transformations within the same culture across region or time.

The study by Sherwood et al on courtyard houses in Los Angeles reveals no more than a visual survey to case studies. It provides no more than simple data about the houses and the uses of the courtyards, whether private or public, despite a rigorous introduction to the case studies. The introduction included ideas about the function of the courtyard and used elements, vegetation and form. The most disappointing aspect in the study about the courtyard is that it ignores any relation of the courtyard to socio-cultural aspects or cross-cultural influences from Spain and the Mediterranean, which the study suggests (Sherwood, 1992).

Another recent study on the physical arrangement of the house in relation to social framework sheds some light on the 'feminine' influences upon the house (Freidman, 1998). In her study 'Women and the making of modern house' Freidman draws attention to the influence of some women clients on the 19th century pioneers of architecture such as Frank Lloyd Wright, and Le Corbusier. Moreover, the study attempts at reading spatio-functional elements of the house from this perspective. Freidman writes: 'the service core at the Farnsworth House becomes a diagram of the house as a machine for extracting order from the environment: the kitchen and the back-to-back bathrooms stand in logical, utilitarian relationship to one another; the fact that the slender, black soil stack is only a tectonic connection between the glass box and the ground lends credibility to this view. Moreover, while the fireplace, which is itself used for extracting energy (in the form of heat) from 'organic compounds' is placed into the core, it too is purely functional and treated diagrammatically; its projection beyond the glass box as a chimney, and therefore its value as a symbolic or pictorial expression of the domestic, is completely suppressed' (Freidman, 1998: 155). The study approaches spatio-functional elements in a new way, reading beyond the physical arrangements in relation to the whole layout, yet lacks objectivity with no general theory to govern the results.

Other studies explored the psychological aspects of the house (Marc, 1977). In his study, Marc approaches the issue from another point of view, as he attempts to interpret the house as an expression and reflection of the 'self'. He identifies symbolic signs and certain geometries that make the human psyche, 'structured according to a general plan which every adept rediscovers in the course of
spiritual disciplines, designed to bring him back to
the unity to be found in the centre of himself. In
the Tibet spiritual experiences of a return to
oneness are expressed by images implying a
centre. The compositions vary only in detail, with a
greater or lesser degree of revelation according to
the spiritual condition of the initiate as he travels
the path to oneness. In Tibet the basic structure of
the mandala was enriched with representations of
traditional deities, characterized by their symbolic
attributes, as well as with elements of the house'
(Marc, 1977: 102). According to Marc, based on
Jung's symbols of Transformation, the human
psyche structural plan is somehow concentric, and
consists of three basic archetypes: the circle, the
square and the cross. Therefore, in detecting forms
within the unconsciousness of the mind to the
cross-cultural common forms regardless the effect
of the ideology, he suggests that these three basic
forms prevailed in different cultures, including an
igloo hut, yurt, house with different basic shapes,
the tent, stupa, mosque, church, Ka'aba, and
pyramid. We find a similar approach to
understanding and interpreting the built
environment in Critchlow's methodology of
analyzing Islamic forms and patterns, based on
spiritual meaning and cosmic natural laws
(Critchlow, 1988).

These studies reveal the inability to provide a
method to retrace and understand the mechanism
by which the layout of the house was constructed.
However, the study by Henry Glassie on the Folk
houses of Middle Virginia is distinguished and
novel in its approach, which we will review next
(Glassie, 1975).

1.1.1 Henry Glassie and the Folk Houses of
Middle Virginia

This study provides an interesting approach to
understanding and retracing social themes
embedded in the physical layout of buildings.
Glassie introduces the idea of 'competence' or the
capability of design to mean 'the set of rules used
consciously or unconsciously to produce artifacts'.
Glassie argues that by looking at competence in the
artifacts the rules that structure the whole house
can be realized, so the product of employing these
rules should be a comprehensible statement or
usable artifact. Glassie writes: 'The plain,
uncluttered form of the vernacular building is the
artful external presentation of its internal idea, the
goal of analysing for artefactual competence is the
create a systematic model that accounts for the
design ability of an idealized maker, a sort of
artificial 'grammar' (Glassie, 1975:17). Glassie
hence focuses in his investigation of the house
form on the concept of 'competence'. To him, it is
an account of not how the house is made, but of
how a house is thought' (Ibid.: 21).

Glassie starts by introducing ideas about the
understanding architecture, which can in turn
provide us with understanding history. He points
out that the discipline of folklore is a natural centre
for the historical study of artifacts.

Furthermore, the study of architecture is an
unnecessarily complicated way to discover the
timeless principles governing human behaviour.
Glassie points out that when looking at change
over long periods of time, changes must be read as
evidence of cultural re-organization and stability as
expressive of deep cultural desire. Therefore,
change is a transformation in which rules govern as
opposed to mere change in the actual physical
aspects of the building design, and hence he rejects
the simple explanation of change as being ascribed
to 'style' or 'type', which are assemblages of
temporarily variable features (Ibid.: 71). Moreover,
change should be detected in artifacts, Glassie
argues, by understanding the actual conceptual
archetype of change itself rather than naïve
superficial identification of certain typological
details. He argues that 'it is not culture's discrete
behavioural or material manifestations that change;
what changes is the ideas that are culture' (Ibid.:
111). Glassie sets out an example of the aesthetic
of the vernacular building as not ornate but logical,
and the façade of a vernacular building offers little
excitement or resistance and always enables the
viewer to predict with some assurance the plan
within. Glassie sees the vernacular building as an
expression of the social activities that occur inside
rather than outside impression. The vernacular
emphasizes that the most important dimensions of
the building lie inside' (Glassie, 1990: 277). He
expresses that again when he writes: 'the experience of the interior makes some artifacts into architecture and brings the student into confrontation with architecture’s main reasons for being the provision of internal spaces to shelter people and help them order social occasions’ (Glassie, 1990: 277). However, Glassie does not ignore the importance of the ‘contextual environment’ as an influential source for the work of the designer's mind.' In general, the abstracted context is the more profound concept; the particularistic context is a descriptive device, whereas the abstract context is an explanatory device' (Glassie, 1975: 115). As trying to understand 'competence' with no relation to 'context' will not allow for the understanding of the decisions that have been taken and those that have been neglected throughout the design process. 'Without considering context, we may be able to describe the competence, but we cannot use the competence to help us understand the decisions that define and refine a particular culture' (Glassie: 1975: 114). The evaluation of the 'context' will then provide a comprehensive understanding of the factors that allow for certain change to happen. However, he distinguishes between what he calls 'particularistic context' and 'abstracted context'; the former is represented by culture within the built environment, whereas the latter is an abstraction within the designer's mind.

In his article about vernacular architecture (Glassie, 1990), Glassie elaborates more on the process of generating architecture. He sees architecture as a cultural fact, which pre-existed in the mind as plans derived from memory, and so can be reversed in analysis. Where things become plans, plans become sets of decisions, and decisions arise from intention. All things embody their creators and become for the period of their existence active images of their creator’s wishes. Therefore, in this sense he believes that vernacular, and non vernacular- are all cultural ways to create, orderings of experience. He writes: 'As a cultural fact, architecture is like any realisation of potential, like any projection of learned ideas. The things of the world - this sentence, that place- in this, buildings are like other cultural things and are no differences among kinds of buildings , like poems, like rituals' (Glassie, 1990: 272).

It is obvious from the writings of Glassie about the vernacular that he gives more importance to the social role of vernacular buildings, and less to the climatic factors in shaping the house. ‘Non-vernacular theories of architectural purpose stress the sheltering functions of buildings, their capacity to create artificial environments, while undervaluing their social goals’ (Glassie, 1990: 279). Moreover, he adds: ‘Buildings must offer both protection from the elements and stages for social play; but the evidence in the vernacular traditions that I know - and I emphasise that none of them developed in extreme climates - is that environmental modification is of less importance than social organization in shaping homes' (Glassie, 1990: 277). Therefore, he sees the house as a social artefact, its main goal not environmental, but social, as 'the house is designed primarily to bring people into intimate interaction and only secondarily to protect them from weather' (Glassie, 1990: 277). Moreover, Glassie describes the house as a pure and true reflection of internal activities, and make easy to read the internal components of a vernacular house as you approach it, where there are no barriers between the internal and the external. He writes: ‘The old homes in the Irish community I studied form around one large central space called a kitchen, it expands through the full depth of the house, lifts to the ridge of the roof, and is entered directly from outside’ (Glassie, 1990: 278). Furthermore, he believes that the social meaning of the house is reflected on the division of its spaces. He writes: ‘but providing a series of spaces into which social activities could be divided for cleanliness and privacy, is for social order. If the internal arrangements are understood in social terms, the vernacular architecture is discovered to be a subtle engineer’ (Ibid.: 279).

In describing the many houses he has been studying, Glassie ends up with an idea about the intimate relationship between the organization of space and the social activities within; he describes the traditional house as open, no barriers block the entrance, outsiders pierce through one door to the very centre of the house. Its interior is composed of
a few large, multifunctional spaces. Entertainment and cooking are communal and people sleep altogether. The plan of the house grows from human activities and its nonsymmetrical facades grow from the plan so that people approaching the house know where its inhabitants are. Such a house is based on trust (Glassie, 1990: 278). In contrast, the modern house is closed, a barrier appears, a porch, lobby blocks the entrance to the house, and the interior fragments into small compartments, servants or women are removed from the houses sociable arena: labour separates from leisure. Then a geometrically symmetrical mask is drawn across the houses facade. Although the visitor can still predict the plan, he does not know where the inhabitants are within the house. Glassie believes that such a house assumes the potential for social disorder and is shaped on distrust and defends against confusion through the rational arrangement of small cells within which behaviour is contained.

On the other hand, he points out that from an external perspective, vernacular building appears first as works of art, as arrangements of volume, void and colour as sculpture. ‘Architectural art, in the traditions I have studied, is invested but minimally in decorative detail. Ornaments are modest in scale, simple in shape, weak in reference’ (Glassie, 1990: 276). In terms of space, Glassie believes that there are no plans for vernacular architecture, and the amount of detail in a plan is an exact measure of the degree of cultural disharmony. Moreover, he sees that in the process of creating vernacular architecture, there is participation, which he considers to be the key to vernacular technology, as well as direct involvement in the manipulation of materials, participation in the process of design, construction and use. As an example of what participation means, Glassie extended this meaning to include a meaning of egalitarian in the process of doing vernacular, as when the designer plans for a client he does not know a dwelling that the designer would be unwilling to inhabit, or when the labourer is asked to create an element for a whole that he does not understand, or when the user is asked to select from among a series of objects which do not suit his needs, then the egalitarian ethic vanishes with the participatory experience.

The political structure becomes one of dominance and submission. Then 'the architectural product is no longer vernacular. It was produced by a society within which the relations among people are not egalitarian; they are exploitative' (Glassie, 1990: 274-275).

Finally, about architecture, and the architect, Glassie sees architecture like any artefact, as double in nature; ends and means; as ends in themselves, they are aesthetic and realization of ideas. Means; as they are tools and aids to human purpose. Glassie conveys a message to the architect; that houses are cultural, that they are profoundly matters of social order, where they cannot be disjoined from economic aspiration and ideas of the sacred, hence they cannot be understood outside of their economic, political, and religious contexts or outside their reality as cultural creations.

Glassie's study sheds light on the underlying patterns within the superficial, physical - yet based on logic that betrays the designer's mind - layouts. His methodology was based on identifying similar and opposite notions and concepts. It could be useful to extract either ideas hidden within an artefactual layout of the same culture or among different cultures, where a systematic process of thinking is believed to be an outcome in the form of the artefacts, hence by reversing the process or by detecting such logical mental thinking through artefacts, differences and similarities could be detected. However, such analysis, according to Glassie, could take place either by means of 'correlative' or 'cognitive' techniques; where the former allows for comparing different cultural aspects in relation to their ordering into patterns, whereas the latter conceives patterns by suggesting explanatory models' (Glassie, 1975: 181).

Having reviewed Glassie's work, in which a new approach can be clearly seen to understand the integral relation between form and function, and how that can be understood in its socio-cultural framework, and most importantly how to be retrieved, we find certain points in Glassie's thinking that come to front stage. One is to do with the study of history, second is about the vernacular,
and third is about architecture and the architect. These points bring to light ideas raised by Hassan Fathy. Therefore, from this point of view, it will be useful to shed more light on these points in comparison between the two. Hence, we ask: What ideas in common can we find between Henry Glassie and Hassan Fathy with regard to these issues? In other words: how does each of them view these three notions: history as a reference, the architect in society, and main aspects in vernacular?

1.1.2 Hassan Fathy versus Henry Glassie

The review of the ideas of Fathy and Glassie makes it is clear that they have different opinions regarding many issues about vernacular. While Glassie concentrates on the social aspect in generating the vernacular house, Fathy tends to refer to society as one of many other factors such as environmental ones. While Fathy points at the trinity: the architect, builder and the client, Glassie describes the house as if there is no architect. And when Fathy describes the vernacular house in the Egyptian village as inward looking where inhabitants do not tend to communicate with the outside, Glassie criticises this type of house as one based on distrust, where internal social interaction should be hospitable to outsiders, as the case with the houses Glassie accounted for.

With regard to history, Glassie seems to look at history with more scientific objectivity before building a theoretical model. When he refers to history he is cautious and warns of using misleading recorded data when applying unscientific method, when the process that allowed for change is not clear, or when the data taken from the past reflects the minority. Fathy’s approach to historical data was less cautious. This could be ascribed to two reasons: the first is that he was motivated to refer to the past as a reaction against Orientalism (Steele, 1997). Hence he was preoccupied with the idea of referring to the past or Arab tradition as a possible viable model rather than referring to an imported one from the West. The second reason is an inclination to clutching at the straws of the past as the ideal model in difference to a threatening spreading wave of international style. Furthermore, by defining architecture as the most traditional art mostly dependent on the past, Fathy takes for granted that some elements or architectural vocabulary developed over generations should be taken as a valuable product. He writes: 'Architecture is still one of the most traditional arts. A work of architecture is meant to be used, its form is largely determined by precedent. The architect should respect the work of his predecessors and the public sensibility by not using his architecture as a medium of personal advertisement. Indeed, no architect can avoid using the work of earlier architects by far the larger part of his work will be in some tradition or other. Then why should he despise tradition into an artificial and uncomfortable synthesis, why should he be so rude to earlier architects as to distort and misapply their ideas, as when an architectural element, evolved over many years to a perfect size, shape and function, is used upside-down or enlarged beyond recognition till it no longer even works properly, simply to gratify his own selfish appetite for fame' (Fathy, 1969: 39). It is notably clear that Fathy considers the past a valid source, but the question is: Can he avoid falling in the trap of mere copying of elements for the sake of it? A contrast can be observed from Glassie whose approach is rather more cautious towards historical precedents as he regards them a means to detect hidden themes and principles rather than an output or a product.

The relationship between the architect and society in Fathy's view is rather one dominating the other; precisely the former has the leading role in creating vernacular architecture to convince the rural society of its value. Fathy, writes: 'When the architect uses the forms in his designs, then the peasants at once begin to look on their own products with pride' (Fathy, 1969: 43). Such a view is refuted by many, such as Rapoport (Rapoport, 1994: 58), where the users or society take control in the process of producing such an architecture. Moreover, according to Glassie it is quite the opposite, where 'the architect’s role is to learn from those people so as to improve his own practice, making it more sensitive to human needs' (Glassie, 1990: 282). However, Fathy's belief in the role of the architect to impose 'tradition' or certain
vernacular architecture values or elements upon rural society, proved to be wrong later on in his career. The community for which he was building his architecture in Qurna opposed his ideas and tried to flood the village he was building for them (Fathy, 1969: 88). Such events cast their shadow upon Fathy's approach to implement the vernacular. Hence, we are inclined to suspect that the vernacular to Fathy, contrary to Glassie, is a set of climatic variables developed over time and social practices that can be revived and recycled for a new society or rather to be superimposed upon it. We can even go further to believe that certain forms and inherited elements rather a process is the core of Fathy's views about the vernacular. Such scepticism can be sustained by looking at Fathy's late works in the Gulf for a different stratum of high class society using forms developed for climatic purposes but no longer function as such in his designs. Such a notion of the vernacular as a product rather than a process is more evident in his thought. To him, tradition and inherited product of vernacular architecture can reach a standstill, and then it is the individual's duty rather than a community to keep it going (Fathy, 1973: 32). Again, this is in all likelihood to happen by adherence to forms and elements rather than a process or collective work by a community as a social event of 'self help' he called for earlier.

In terms of space and the reflections on the social activity within the house, Glassie distinguishes between vernacular and non vernacular as the former is readable from the outside, and the internal spaces are reflected in the forms. At the same time the space in the vernacular is not divided to allow multiple activities to place altogether, and to Glassie this is the social aspect which has the most effect upon the users. Fathy mentions the appearance of the building to have the most profound effect upon its inhabitants.

In summary, it seems that Fathy to a large extent views the vernacular as a ‘product’ to be respected to a great deal, hence announcing the emergence of a ‘style’ and a formalistic architecture ascribed to him and his followers. One example is his student Abdel Wahid Al-Wakil whose works in the Gulf, particularly in Saudi Arabia, have nothing to do with vernacular but rather a ‘style’ of forms, domes and vaults. This is even worse if we know that the wind catcher or the *malqaf* is not functional, the courtyard is not accessible, thick walls were built using materials that transmit heat. In other words, Fathy applied past precedents which may have changed completely at the risk of ignoring contemporary social demands. Glassie on the other hand, recorded the end product of past people to detect a methodology of thinking.

Having reviewed such approaches to domestic architecture by those writers, we go further to search for studies on the Arab house and the various studies to understand it.

2. Studies on the Arab house

Arab historians as well as western travelers have accounted for studies on the Arab house. The historical manuscripts of Al-Maqrizi (1364 -1442 A.D) and Ibn Battuta (1304-1377A.D) alongside Arab literature; novels and stories such as The Thousand and One Nights & 'Between the Two Palaces' have all provided scattered details of social life and the architecture of Arab houses in the middle ages in great Arabian cities like Cairo or Baghdad. Similarly, travellers to the Orient such as David Roberts depicted magnificently Arab architecture and aspects of society (Figure 1). Such important sources have provided scholars with information to understand aspects of the Arab house and social life.

Available literature on the Arab house, however, include: Basim Hakim's 'Arabic- Islamic Cities’ in 1986 which explores the morphology of the Tunisian house, Warren-Fathi's 'The Traditional Houses of Baghdad' in 1982, or Revault's ‘Palais et Demeures de Tunis’ in 1967 & his Palais et Demeures de Caire’ in 1982, or 'Traditional Houses of Salt' in 1987, and Hassan Fathy's 'Natural Energy and Vernacular Architecture' in 1986. It is notable that most of these studies either dealt with the form of the Arab house, or focused on aspects of its vernacular nature or both.
However, another category of studies, more deep and rigorous, emerged following the novel programme at the Bartlett by Hillier et al to understand the spatial organisation of buildings. Studies of this type are: Amorim's application of the theory upon Brazilian houses (Amorim, 1999), Orhun's study on Turkish houses (Orhun, 1995, 1996), or Al-Bahar's study on Kuwaiti houses. Moreover, Hanson & El-Gohary explored houses of El-Hekr in Cairo in 1997. All these studies followed the footsteps of Hillier's study of French houses (Hillier, 1987). In addition, Julienne Hanson's 'Decoding Homes and Houses' in 1998 is an account of this approach derived from Hillier et al's Space Syntax theory. Such available studies form a fertile soil to seek a methodology to explore vernacular architecture.

2.1 Studies on the form of Arab house

Basim Hakim used Tunisian houses, and other building types, to study the morphology of the city as an example of the evolution of a traditional Arabic-Islamic city (Hakim, 1986). His aim was to record the building and planning principles behind the formation of the city. The study is a brief useful survey of typical morphological features of houses that attempts to understand Tunis through its organic components by de-constructing the city organs. However, since the study is not directly aimed to explore Tunisian houses it offers little to understand the house, let alone on a deep level.

Revault's study ‘Palais et Demeures de Tunis’ in 1967, is a good reference for houses in Tunis in many aspects; first it documents all traditional houses in the city with a clear account on the spatial structure of the house itself on the one hand, and in relation to its location within the urban form on the other. It, however, starts with a background about the city of Tunis from many aspects that influenced the evolution of the urban form on its macro and micro levels. It investigates building material, structures, in addition to reflections on the conservation efforts to maintain these traditional houses. However, the descriptive study at best is a good documentation for further research. It provides broad historical data on the evolution of certain parts of the house as well as details, climatic issues and building materials.

Warren and Fathi's studied exclusively Baghdad traditional houses (Warren et al, 1982) in an attempt to understand the evolution of the Baghdadi house. The study investigates the house form, its components, and detects the evolution of certain elements such as the courtyard and the tarma, a colonnaded gallery in the second floor, with cross reference to various types of houses. The study is credited for its thorough investigation to various physical and 'form(al) aspects of the house. It is restricted, however, to providing basic data on the physical layout of the house.

The study of Salt houses in Jordan, carried out by the RSRS, aims to document the houses as part of the traditional heritage of this unique city. It is more or less an as-built field survey with no aim to analyse or to cross-examine the layouts. However, the study classifies the houses into main types according to building material, construction methods, or spatial features such as the existence or absence of a courtyard and its location within the house. It is best described as documentary with no aim to explore beyond the 'form(al) level.

2.2 Environmental studies on Arab houses

Studies of the Arab house are often found under other issues, such as the effects of environment
upon architecture, or under the concept of vernacular architecture. Many studies on the evolution of house are ascribed to the climate, such as Talib's study on the shelter in Saudi Arabia (Talib, 1984). It begins with the tent exploring spatio-functional aspects of its simple layout (Talib, 1984: 28). However, this descriptive environmental study argues that types of vegetation can provide solutions for high temperatures in hot arid zones and that different types of houses, tower and courtyard ones are outcomes of climate (Talib, 1984: 28).

Hassan Fathy's 'Natural Energy and Vernacular Architecture' in 1986 is an example of studies on the Arab house in relation to climatic context. In his study, Fathy aims to test the effect of climate upon the form of vernacular architecture by quantifying wind movement, and temperature in various parts of traditional houses in Cairo (Fathy, 1986: xx). He claims a link between climate and architectural form (Ibid.:4), where, according to him, window form has been adapted to fit the temperature in hot climates to control energy inside the building. For example in Fig.2, he refers to the wind catcher as products of climate to control temperature.

Therefore, as Fig.2 shows, Fathy tested the movement of air, its velocity, and temperature between the Qa'a (the reception hall, normally double height as shown in Fig.2) in the house and the wind catcher. He concludes that physical and aerodynamic analysis has shown that design concepts embedded in traditional houses remain valid in present (Ibid.: xxii).

Warren & Fathi study to Baghdadi houses have an environmental perspective as it explores the effects of climate on the structure of the house. They claim a direct relation between the use of spaces around the courtyard in relation to the sun movement (Warren & Fathi, 1982: 103). In Fig. 3, the study shows a 20 C difference between levels in the house giving inhabitants the choice of occupying spaces in each level accordingly (Ibid.: 102-103). These studies suggested a strong link between constant environmental factors such as climate and the form (i.e. the invention of elements such as Malqaf) on the one hand and between climate and the structure (the invention of spaces such as the tarma, or the Maqa'ad) of the Baghdadi house.

However, while the former tends to generalise from the part (Cairo houses), the latter remains local in the sense that it confines its findings to the houses investigated in Baghdad. Moreover, Warren & Fathi study remains incomplete as it lacks a systematic approach. For example, the authors attempt to provide a typology for prevailing elements, but the result is again a fragmented
material poorly presented. The study could be best described as a starting point to research.

2.3 Socio-cultural studies on the Arab house

Among studies of this type we find Paul Oliver's *Encyclopaedia of Vernacular Architecture of the World* in 1997 in which he conducted an exclusive regional survey, notably combining three forms of lifestyle, sedentary, rural and urban. The study included descriptions on building material, climatic and social variations between regions, and spatial organisation of some houses. Oliver extends his study to houses in Arab cities, such as houses in Iraq (Fig. 4-a), Saudi Arabia (Fig.4-b), or Egypt (Fig.4-c). In these examples, his study accounts for the effect upon the vertical structure of the house, for example as in (Fig. 4-a), he writes 'In the inland desert cities, ..., the large mud-brick courtyard complexes are notable for their deep basement systems. Like the Baghdadi house, they also have small parapet wind catchers. The traditional Iraqi features of colonnaded galleries (tarma) around the ground and first floor courts is typical.' (Oliver, 1997: 1586). In contrast to his account on the Baghdadi house, we find that he suggests social aspects of interface between inhabitants and visitors when he studies the house in the southern part of Saudi Arabia (Fig. 4-b), he refers the vertical organisation to this interface. He writes 'The ground floor was the salamlek, the public male area, ..., the upper floors, Harim, were for the family ..' (Ibid.: 1454). On another level of his study, he invokes recent studies by space syntax researchers at the Bartlett to further his investigation. For example, when studying certain house types in El-Hekr in Cairo, he refers to a study by El-Gohary and Hanson in 1994 that utilises the Space Syntax application program (Fig. 4-c). In this study, it has been found -based on space syntax analysis- that despite the fact that each house appears superficially to be spatially unique, computer based analysis reveals variations upon a space 'genotypical' theme, a physiography which lies beneath the diverse physiognomy of the plans; impregnated with cultural values.
Al-Bahar's Ph.D. thesis at the Bartlett 'The Evolution of Kuwaiti Domestic Architecture' in 1990 aims to examine the evolution of Kuwait's domestic forms in the context of the evolving economic, social and other factors. The study utilizes 111 traditional and modern houses that represent pre-oil and post-oil eras in Kuwait. It adopts a methodology that combines Hillier et al.'s syntactic theory with ideas on representational analysis by Glassie. The study concludes that differences found in spatial and representational forms between traditional and modern houses in Kuwait are reflections of an underlying socio-cultural forms in both societies, where differential gender factors dictated a class difference in the pre-oil traditional society in Kuwait, the pre-oil society reflected national structure of society based on the differentiation between Kuaities and non-kuaities. However, the study argues that social change happened in a much more rapid speed than the change in spatial structure in the modern society expressed by house spatial layouts. In this study, spatial patterns of a selected sample of houses have been subjected to analysis by means of space syntax, which attempt to extract hidden social aspects. Such studies form a new approach to the analysis of the layouts of houses and seem to be most effective to date.

The previous studies raised certain points: First, the analysis on the Arab house across the Arab world has been subjected to various explanations. While some ascribed form variations to environmental issues, others viewed these variations in the light of social factors. Despite these approaches, all the previous studies without exception were concerned with exploring various factors that affect the house in certain places and times with no account or a comparative study across regions.

Second, the demarcation of domains within the house seems to be an aspect of certain social traditions. It therefore dictates the relations in the house. On this general level, we find that such descriptions, according to Warren or Varanda, divide the house to two main domains; the haramlek or the women's domain, and the salamlek or the men's domain (Varanda, 1982: 274, Warren et al, 1982: 102). Moreover, according to Mitchell and others, the style of life in the Arab house is said to depend on the privacy and the controlled encounter between visitors and inhabitants within the two domains (Mitchell, 1987: 198-199, Varanda, 1982: 84, Warren, 1982: 45), where within the male domain guests can be admitted to certain point and the space allocated for this purpose depends on the wealth of the owner and how big the house is. In Cairo houses, for example, this takes the form of the Qa’a, which could be found in both domains (Qa’a is the main space of salamlek or haramlek where guests are received in the former, and where family lives in the latter). In other houses like in Sana'a, Lewcock noted that guests are received in one of two spaces depending on the degree of closeness of the guest to the family; either in the diwan in the second floor, or in the mafraj in the last floor (Lewcock, 1988: 436, Freeman, 1981: 122-123, Varanda, 1982: 88.). These spaces were mentioned in historical references. For example, the Qa’a as the main space for night life. Women from the upper floor can sit behind lattice screens and participate. Historic events, as in Tales of Arabian Nights or Between the Two Palaces, depict women from that place used to participate in literature and poetry competitions.

From this, we can conclude that spatial organisation can be analysed in terms of gender and function; that is in order to analyse the structure of the house it is not enough to identify the spatial distribution regardless of their...
functional assignment, but it should be analysed once as spatial structure, and another as spatio-functional structure based on gender domains, and the relation within the house between inhabitants and guests.

However, these studies seem to offer very little towards understanding the physical layout in relation to its socio-cultural meaning or at extracting hidden themes, except what we found in Glassie’s analysis to houses of Virginia. Therefore, within this quest to find an appropriate theory that attempts to understand the physical layout in relation to socio-cultural context, a theory called space syntax seems to have more to offer. So what is space syntax theory all about?

3. A new approach: Space Syntax

Space Syntax is one of the most recent and distinguished theories that establish a strong link between ‘space’ and ‘society’. It was generated and developed over three decades from 1970 by Bill Hillier and his colleagues at the Bartlett School. According to Hillier’s theory, the concern is the space rather than the form, style, or shape. Moreover, it is concerned about the understanding, evaluating, and analyzing spatial relationships.

Space syntax is defined by Hillier as: ‘a set of techniques for the representation, quantification, and interpretation of spatial configuration in buildings and settlements’ (Hillier and Hanson, 1984). One of its main ideas is ‘cultural ideas are objectively present in artifacts as much as they are subjectively present in minds’ (Hillier et al, 1987). This implies that buildings, as well as settlements, represent spatial artifacts composed to fulfill social purposes in which cultural and social themes are embedded, more specifically, these themes are within their spatial structure and can be retrieved and understood by analysing ‘space’.

Space Syntax literature spans over thirty years since its early formation in the mid seventies throughout many publications. However, the two books that best introduce the theory are: The social logic Space by Hillier & Hanson in 1984, which formulated the early synthesis of the theory, and Space is the Machine by Hillier in 1996, in which he puts forward the theory and its applications on space in both buildings and urban settlements. The most recent book ‘Decoding homes and houses’ by Hanson in 1998 provides a set of collective efforts by the author and her colleagues at the Bartlett to understand domestic space by means of the theory. In addition to these main books, we find a comprehensive review in ‘Architectural morphology’ (Steadman, 1983: 215-239) as well as papers published in the international space syntax symposia held every two years since 1997.

However, space syntax theory does not find acceptance among some scholars. Osman, for example, argues that it lacks the efficiency in representing social phenomena across cultures (Osman et al, 1994). Others like Teklenberg dispute the fundamental mathematical procedure in generating the findings of integration values to allow comparison between two different spatial systems with different sizes (Teklenberg et al, 1992, Teklenberg et al, 1993). However, space syntax theory has proved to be the only powerful scientific means, so far, to read and extract themes embedded in physical structure of buildings and settlements. Extensive research conducted by scholars from different backgrounds and cultures utilizing the measures and tools it provides are evident to show the capability of the theory to provide a basic platform for discussions and comparisons of samples of buildings across time and place, hence providing means for scholars to read beyond the physical layouts. What is striking about space syntax is its ability to show by means of figures, graphs and colours differences and similarities between two or more spatial layouts.

The theory implements a scientific mathematical framework to analyse space as whole in relation to all configurations in the complex. Therefore Hillier’s theory proposes that ‘in general, the form-function relation in buildings and cities passes through the structural properties of the whole configurations’ (Hillier, 1998: 37). Moreover, the principal axiom for the whole syntax theory as Hillier puts it: ‘spatial organization is a function of the form of social solidarity; and different forms of social solidarity are themselves built on the foundations of a society as both a spatial and a
transpatial system' (Hillier & Hanson, 1984: 142), where there is an intimate link between the principles of social organization and the way society works, such a link has its roots in spatial arrangements as a means and as a context.

In Hillier's theory, the spatial patterns are described numerically by means of many tools. Yet the uniqueness of the theory lies in its methodology, where these numerical findings are interpreted in the light of their socio-cultural context, to allow for the reading of the hidden socio-cultural transmitted rules through the abstracted-physical form that has been decoded into mathematical relations. In this regard, the theory avoids most of the errors that other descriptive studies fall into, by allowing for the detection of architectural readings of buildings or settlements without recourse to subjectivity in the findings, but rather referring the findings to the inherited meanings that the physical form hides. In other words, it decodes the physical layout and retrieves themes, relying on mathematical principles, which any of the previewed studies or even any known urban or architectural theory has failed to achieve so far.

The concept of social solidarity is traced in sociological studies such as these by Durkheim, where a reflection of spatial aspects has been made upon society in his works. Hillier and Hanson believe that in general, his theoretical sociology, particularly when addressing social solidarity, his study is profoundly suggestive (Hillier and Hanson, 1984: 18). Durkheim derives the idea of social solidarity from the interrelation between what he calls 'common conscience', and 'personal conscience'. If this interrelation is based on similarities, then he calls it 'mechanical solidarity', if it is based on interdependence or difference, then it is called 'organic'. In the same manner, Hillier and Hanson suggest a similar comparison to identify spatio-logics in society (Hillier and Hanson, 1984: 20). Moreover, Hillier and Hanson identify and explain 'spatial and transpatial' aspects associated to social formation, where the latter is embedded architecturally in spatial form or layout, that can be traced or retrieved by investigating space-society logics and interdependent relation (Ibid.: 42). Hillier and Hanson use the term 'morphic language' as 'the realisation of abstract structure in the real world. They convey meaning not in the sense of representing something else, but only in the sense of constituting a pattern' (Ibid.: 50). Hence, the approach of Hillier's theory is based on mathematics to detect orders and patterns within spatial structures by converting it to a basic abstract mathematical form. By doing so, certain equivalent social patterns embedded within the spatial layout would be identified and interpreted accordingly if such social patterns and spatial organisation are within the framework of 'morphic languages'.

Hillier and Hanson argue that buildings do not only express social meaning, but rather constitute that meaning through the ordering of space. Buildings are therefore 'not just objects but transformations of space through objects' (Ibid.: 9). Therefore, they possess a spatio-temporal existence in the real world by their physical existence, yet they must have certain rules that govern their spatiotemporal nature (Ibid.: 34). With reference to Durkheim's classifications, based on the appearance of patterns or types on a consistent order, one can identify 'genotypes' either of means or of ends (Ibid.: 210).

Recent 'space' studies on the configuration of vernacular houses, most notably those of Hanson, reveal that social values embedded in the built form can be retrieved in a very powerful way by utilising what is defined as spatio-functional inequality genotypes, which could be found when a consistent pattern happens among a set of case study sample (Hillier et al, 1987, Hillier, 1996, Hanson, 1998). However, space syntax is not only a theory, but it has its application programme, where certain tools have been developed over years. There will be introduction next to explain the measures of analysis. The problem of how to describe this non-physical element in terms of quantitative measurements defined a set of techniques to represent the elements of 'space to the overall spatial system in mathematical terms (Hillier, 1996). So what are the tools used to quantify, analyse, and interpret spatial relations within a structure using space syntax?
3.1 Space syntax tools and measures for analysis

In space syntax tools measure spatial qualities and allow for the description of various spatial patterns which arise from the differences in what is called spatial configuration, defined syntactically by Hillier, as 'the relations exist between a finite number of spaces in a simple or a complex spatial system taking into consideration all other spaces in the complex' (Hillier, 1998: 37).

Concave space: the line drawn from A to B can go outside the space. Convex spaces: no line drawn from any given two points within the space will go outside the space.

The first step in Space Syntax theory in understanding space and in constructing the syntactic model in any spatial layout, is to deconstruct it into its series of 'convex' spaces. The formal mathematical definition of 'convex space', according to Hillier, is' the space that no tangent drawn on the perimeter passes through the space at any point' (Hillier and Hanson, 1984: 97). According to this definition, the first three spaces in Fig. 5 are convex spaces, whereas the fourth space is not. The importance of the use of convex spaces is because they represent our real understanding of space when we are within a spatial system. Based on the convex spaces we formulate the 'convex map' defined as 'a map of spaces broken up into the fattest possible convex spaces' (Hillier and Hanson, 1984: 97). See Fig. 6

In space syntax, tools can measure spatial qualities and therefore allow for the description of various spatial patterns which arise from the differences in what is called 'spatial configuration'. Spatial configuration is defined syntactically as the relations that exist between a finite number of spaces in a simple or a complex spatial system, taking into consideration all other spaces in the complex (Hillier, 1998: 37).
change when a third space is introduced, in addition to the way each of them may be connected to this third one. Such permeability structure can be represented by the 'justified graph', (shown in Fig. 7), which is one of the powerful means to capture spatial relations and to further explore spatial and syntactic measures derived from its properties.

The 'justified graph' represents the relation between spaces in terms of permeability. It represents three main elements: firstly a root space from which the graph has been drawn, and hence all other spaces are counted from in terms of how many steps they are situated in the structure from that particular space, secondly, all spaces represented as circles, and thirdly, the permeability between spaces shown as lines connecting them. Therefore the graph indicates how directly or indirectly spaces are related to each other. From the 'justified graph' a relational model can be built, taking into account the relation between the part ‘element’ to the whole ‘the spatial system’ (Hillier and Hanson, 1984: 106). The representation of any spatial system is based on the fact that we have three types of relations between spaces in a certain spatial system: adjacency, accessibility or visibility. The ‘accessibility’ of spaces is the basic property of a spatial model that differentiates between similar spatial systems in terms of geometry and adjacency. It can be represented powerfully by means of the justified graphs.

For example, if we look at Fig. 8, we see four spatial layouts with identical geometrical and adjacency graphs. However, the four layouts are not identical in terms of accessibility from one space to another, which can be easily revealed by means of the four corresponding justified graphs in Fig. 8. The importance of the 'justified graph of any spatial pattern lies in its ability to allow us to see configurational properties of the spatial layout. Firstly, we can capture 'depth', which in a justified graph is represented by the height of the graph, in other words, the many levels from the root space to the farthest space from that root. From that we can examine how deep or shallow a space can be within a spatial pattern from any other space. Second is the 'connectivity' of spaces within the pattern, which can reveal the extent to which spaces are linked together, hence forming a 'ringy' type of pattern. This reveals the many choices that exist from a particular space to another one, or can reveal a tree type of justified graph if it contains K number of spaces and K-1 links, where spaces have single routes from one to another. Therefore, ringyness can be expressed numerically by calculating the number of links in the justified graph plus one, over the number of spaces. The result is called space link ratio (SLR), it is a value between 1 (for a tree-like structure with no links at all), and above 1 for the degree of ringyness.

Also, the 'justified graph' through its depth property provides us with a numerical quantitative measure called 'integration value'. It is a representation in numbers of the shape of the J-graph from one given space in relation to all other spaces in the pattern, which also can be thought of as 'Relative asymmetry' or RA value (Hillier and Hanson, 1984: 109). The integration value can be calculated numerically according to the following equation: (the mean depth of spaces in the spatial system -1) multiplied by 2, all divided by the total number of spaces minus 2 (Hillier &Hanson, 1984: 108, Hillier et al, 1984: 364).

RA= (2(MD-1))/(K-2)

where MD is the mean depth and K is the number of spaces in the system. This gives a value between 0 and 1. Low values indicate to a space from which
the system is shallow, or tends to integrate the system, and a higher value indicates to a segregated space from the system (Hillier and Hanson, 1984: 109). However, in order to eliminate the effect of size (i.e. the number of spaces within the system) when comparing more than one spatial system, the RA is transformed to give a 'Real Relative Asymmetry' value RRA (Hillier & Hanson, 1984: 109-110).

The properties of distributedness and non-distributedness are further measures to capture spatial properties of depth and permeability in the structure. If we consider two spaces x and y, then a spatial system is distributed if there exists more than one route from one space to another, and non-distributed if there is only one. According to Hillier, in a non-distributed system there will never be more than one route from one point to another, whereas in a distributed system routes will always form rings (Hillier & Hanson, 1984: 94). For example, in (Fig. 9 - I) there is only one route from x to either y or z, whereas in II, it is possible to go from x to y via more than one route. This distributedness/non-distributedness measure can be explored in a spatial system according to the prevailing types of spaces in the system. However, in order to explain what that means, we have to introduce the typology of space measure first.

Another powerful measure to be obtained from the justified graphs is the typology of space. Hillier defines four possible types of space that meet the requirements of occupation and movement in any complex. The first, he calls ‘a’ type, which are spaces with single link, and by definition dead-end spaces through which no movement is possible to other spaces, and by nature they are occupation-only spaces. The second is ‘b’ type, which are spaces with more than one link and form part of a connected sub-complex in which the number of links is one less than the number of spaces. These spaces cannot be themselves deadend spaces but must be on the way to and back from at least one dead end space.

The third type, Hillier defines, is ‘c’ type, which are spaces with more than one link that form part of a connected sub-complex that contains neither type ‘a’ nor type ‘b’ spaces, by definition a ‘c’ space lies on at least one ring \(^1\). The fourth is ‘d’ type, which are spaces with more than two links and form part of complexes that contain neither type ‘a’ nor type ‘b’ spaces. It must contain at least two rings which at least have one space in common. Such type of spaces must lie on more than one ring (Hillier, 1996: 318-320). Examples of these four types are shown in Fig. 10.

Having introduced the space types, we go back to 'distributedness'/nondistributedness', which can be expressed in terms of space types in the system. According to the distributed definition, this means the existence of c and d types of spaces, therefore a distributed system can be measured by adding c+d space types in the system, whereas a non-distributed system where there is only one route, can be measured by adding a and b spaces.

Another measure to explore further spatial qualities that can be derived from the justified graphs and tests differences between spatial systems is the integration and segregation values, these values can be investigated by means of space types. Hillier noted that b and c types cause segregation
in a spatial system, whereas a and d space types cause integration (Hillier, 1996), therefore the relation between segregation and integration in a spatial system can be measured by calculating segregation over integration or \((b+c)/(a+d)\).

From such measures and calculations, analysis can be advanced to observe certain aspects within the same system, or between two or more spatial systems, as for instance, when a consistency in the order of integration of a set of functions is found then that could indicate to what is called inequality genotype’ (Hillier and Hanson, 1984: 150). This is a strong measure to pinpoint underlined hidden typological differences among sets of spatial layouts. The extent to which the inequality in the integration values of three functions can reveal the degree of differentiation or what is called ‘the difference factor’. The difference factor (DF) can express the degree of differentiation among integration values or any chosen three functional-space values. According to Hillier et al, it is one of the means to show how strongly social relations express themselves through space (Hillier et al, 1987). It measures how strongly or weakly a consistency is maintained within a spatial pattern by calculating the degree of difference among the integration value of three (or more) spaces (Hillier et all, 1995: 481).The smaller the difference between any chosen three RRA values of spaces, the closer the DF will be to 1, which indicates to weak DF, whereas when the difference between the three spaces is large, the DF will be tending towards 0, and hence indicate a strong value of DF, and thus the more structured the genotype will be in relation to the functions of the three spaces chosen.

3.2 The procedure of the analysis in space syntax

In space syntax analysis, spaces1 are broken up into convex spaces. The exterior is regarded as one space. However, if the house has more than one entrance the exterior is regarded as one space. Therefore, links to the exterior space show the number of entrances. Taking these points into consideration, the procedure is carried out as follows: The justified graphs for each house are drawn from the outside space, then space-connections are written in columns as illustrated in Fig.11. The results are then imported to New Wave, an application program that calculates syntactic properties that can be viewed in StatView as columns. The main data table for houses obtained in Stat View is the base for analysis to ask questions and draw results. However, other tools to represent configurational properties in space syntax include Pesh, which is an application used for analysing domestic and complex buildings and small urban systems. It can use any graphical object, line square, polygon or circle to form the nodes of the graph. Due to its flexibility, Pesh can be used for a variety of analysis, including axial analysis, convex shape analysis, formal properties analysis, facade analysis and symmetry testing 3.

Fig. 11: Preparing data for analysis using Netbox and NewWave.

First: to use NetBox to draw J-g, Second: to number spaces in the J-graph starting from the space root, third: write the connections between spaces starting from the space root in rows as above:

Fig. 12 - A below shows a convex map produced using Pesh. The program calculates the integration values for each convex space and assigns a certain colour to the result accordingly as in graph B (The results correspond to rainbow colours in a descending order, where red is the most integrated, and violet is the least integrated).

Hence, as graph B shows, the central convex space, the courtyard, is the most integrated. It has to be noted that these results represent the visual version of those produced using NewWave. In graph C, the convex spaces are combined with the
axial lines in the house that represent the longest axial lines which link as many spaces as possible in one single axial line.

Fig. 12: A/Convex map of Dahabi house in Cairo. B/ Pesh analysis of the convex spaces. C/ Pesh analysis for a combined map of axial and convex map.

Conclusion

Our search for an approach to study and understand settlements and buildings within the context of the vernacular has landed us finally to introduce Space Syntax theory, which has proved over the years to provide rigorous interesting results when combined with social and cultural data to interpret hidden meanings embedded in the spatial structure. Where other methodologies have failed, it seems Space Syntax has managed, at least, to put forward a theory that can quantify space for the first time and enable us to tabulate the results, then to be able to compare structured, not based on shape or form, but rather based on the integral properties of space, form and function of each structure.

One example of utilizing this theory is the research conducted at the Ph.D. level of the author of this paper, that examined structures and settlement of vernacular architecture, which has produced interesting results. Therefore, this methodology seems to have opened the door wide open for further research.

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1 The ’c’ type of space was first defined in Space in the Machine, but was later modified upon finding a case that does not meet the terms of the original definition. See Hillier’s ‘A note on the Clarification of Space Types’, published paper, 2004.

2 This definition is taken from space syntax website at: http://www.spacesyntaxlaboratory.org/software/index.html, visited on 29/5/02.