The Village and the City

Ref 002

A Diagnostic Study of the Spatial Embedding Patterns in Villages Absorbed by Cities in Bahrain

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Abstract
During the growth of cities villages are frequently absorbed into the fabric of that conurbation. But what are the consequences of this? To what extent and how well do these villages become part of the overall fabric of the city? What is the effect on the village and the wider city? How do these villages interact with the configuration of the city to create a rich spatial urban structure? This study focuses on the spatial distribution of the internal and edge commercial activity within the villages absorbed by Manama and Muharraq, cities of Bahrain, and their correspondence with the syntactic factors as a key factor for the subject. Fully understanding these interactions entails answering three critical questions: Does the commercial activity on the streets in the ten villages of Manama and Muharraq differ in configuration and scale? If yes, what is the level of the differences? How does the commercial activity in these villages relate to the structure of the city? Are the commercial activities related to the local or global structure of the city? Are the commercial activities in absorbed villages part of the context or are they distinguished? What are the spatial dimensions of the commercial activity of the village and how do they determine the means of creating a superior spatial structure in the city? Theses questions are addressed in this paper against the background of a coherent body of literature which uses the space syntax theory and methods, and offers a certain rigour in the analysis of spatial layout. Its syntactic concepts also provide a rigorous spatial framework for the analysis, enabling us to study the key attributes of the absorbed villages in a city context. It is the intention of this paper to develop deep syntactic studies of villages absorbed in a city's fabric by identifying different spatial factors, and looking at their performance over different scales from local to global radii. It focuses on explicitly exploring the properties of contextual structure in the formation of absorbed villages rather than simply the properties of the internal structure. It seeks to contribute to a better understanding of the spatial city structure. The framework is built through a comparison case study of ten villages absorbed by the cities of Manama and Muharraq. The paper explores the relationships between different components such as, on the one hand, spatial factors, and on the other hand, social and economic factors of the villages. It shows that the main dimension of spatial layout of commercial activity derives from a set of basic principles. Depending on the way a village's commercial streets become part of the context or are kept separate from the context, it is possible to distinguish different spatial relationships between the village and the city's fabric.

Introduction

During the growth of cities, villages are absorbed into the fabric of that conurbation. But what are the consequences of this? To what extent and how well do these villages become part of the overall fabric? What is the effect on the village and the wider city? This paper presents research findings regarding the relationships between the city's structure and the spatial dimensions of the villages absorbed by a city, examining two different cities' structures in Bahrain. The syntactic studies seek to develop a theoretical understanding based on empirical knowledge and comparative, intensive study of the ten villages absorbed by Manama and Muharraq cities in Bahrain. The paper will focus on the spatial dimension of the commercial activity within the villages and the relationship to city structure as a key issue, theoretical as well as practical. The paper looks at the

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002:1

spatial relationships between the commercial streets of the village and the spatial system of the city. Precisely, the first part of the paper discusses the main dimensions of spatial variability in the villages, while the second discusses the spatial variability of commercial and non-commercial activity. Using these discussions, the final part seeks to build an overall model of the underlying principles governing different configurations of commercial activity and their relationships on the city's spatial structure.

Before developing the argument, here are a few words on the why the case studies were selected. The cases of Manama and Muharraq cities demonstrate two differences in configurations, structure, and growth. In theory Muharraq had grown outward while Manama's growth has been inward (Jafar, 1975).[1] The two cities experienced major changes in their urban structure after the 1970s due to rapid urban expansion. Villages in the vicinity were gradually engulfed by the cities' fabrics (Jafar, 1975, Khuri, 1980, Hamouche, 2007). These physical changes of villages absorbed in the two cities' fabrics convey changes of relationships in the spatial system of the cities. In some cases the absorbed village seemed to become part of the natural area or structure of the city, and in other cases they seemed to stand apart from city structure and remained more or less separate entities. These changes can mean the dissolution of some relationships. This is normally accompanied by the emergence of new and sometimes more complex relationships. Several researchers have studied this phenomenon from geographical, anthropological, and socio-economic points of view (Adrian, Aguilar, and Ward, 2003, Drakakis-Smith, 2000, Dogon and Kasarda, 1988, Nock, 2000, Guldin 2001, Dayaratne, Samarawickrama, and Neng Li, 1997).[2] These studies see this complex combination of villages and cities as the defining landscape of the twenty-first century in most cities, despite the unique patterns of earlier development (Sieverts, 2003). Although much work has been done to understand and document this phenomenon, less has been accomplished by way of systematic measurement of it and addressing the spatial dimension in any depth. The ability to make precise and systematic comparisons between different spatial configurations requires a language of spatial description, which is provided by space syntax.

Manama and Muharraq urban development
Bahrain is characterized by the urbanization of its northern areas and desertification of its southern regions. Apart from the two cities Manama and Muharraq that were founded around 1783, other settlements, up to eighty, were villages and hamlets (State of Bahrain, Jafar, 1975).[3] From 1939 on maps show that the old towns and villages were scattered in the northern part of the country, mostly along the coastline. In theory Manama has gone through three phases at different periods of time before the 1970s. During the first phase the city core grew around an old town centre in front of the sea at the northern part of Bahrain Island. Growth was inward, verifying the city concentric theory. Manama's nucleus had grown along the sea front to north Bahrain Island stretching approximately 1.5 km, from a starting point which is the present old harbour of Manama. It expanded eastward and westward first and then about one kilometre in depth to the south. The core consisted of today's old city of Manama with its old souk and mixed inhabitants structure. There was no natural barrier to the city's expansion except the sea to the north and east, as well as a series of ethnic cemeteries surrounding the city nucleus. The circle was completed by the Manama fort with its massive structure on the southwest side. This ring of properties had a considerable impact on the growth of the inner city. The old city's core remained within these confines for a long time, finding its own way to grow, which was greatly influenced by the city's function as a harbour and trade centre for re-export to the entire Gulf region (State of Bahrain, Abu-Elez, 1975).

In the second phase, several of Manama's residential areas in the old centre expanded beyond the old core. Simultaneously the areas surrounding the old city began to be developed too, in accordance with the sector theory of city growth. By the 1970s the third phase occurred. Manama had expanded to integrate the surrounding villages and areas to the south and west. This is consistent with the multi-nuclei theory of city growth (State of Bahrain, 1975). Roads had been built to connect various interests within a group of villages and hamlets including Juffair, Um al-Husum, and Mahuz. The city had begun to take shape, although its outer dimensions still lacked integration and contiguity. In the southwest expansion occurred along a road built to link Manama with a new planned town called Awali, and the nearby island called Sitra. In addition, a number of villages were connected on both sides of the road. This expansion was not administratively incorporated

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002:2

into the city of Manama but was a natural development as important as urban expansion in the south.

The three phases strongly overlapping the city's morphology are extremely mixed. This overlapping may be attributed to many interconnected factors such as a number of residential areas turned into commercial centres, and rural quarters being developed into new residential areas. The result was relationships between groups of sub-centres such as surrounding villages and areas linked with the city fabric of Manama. By the 1980s Manama's boundaries included substantial areas for reclamation at the north, east, and south coastlines (Ministry of Housing and Planning, 2000). These reclamation processes were concentrated around the following villages: RasRuman, Hoorah, and Naim in Manama. The reclaimed areas were later linked together by ring roads.

In contrast, the city of Muharraq grew around a nucleus at the centre of the city. It grew outward with its morphology. The social-urban elements are aligned in a structure that seems to grow out of the centre of the city. Muharraq is delineated in this form within a peninsula surrounded by water from the east, west, and south. The land in the northern part of the city is occupied by a cemetery, the village of Busaiteen, and the barracks of a former British base. As a result, in the 1970s Muharraq had only limited space for expansion in the northeast and along the coast up to the village of Busaiteen. The city has retained a semi-uniform geometrical shape dictated by its location. This may explain the city's stunted growth compared to Manama (State of Bahrain, 1975). By the 1980s Muharraq included substantial areas for reclamation in the east, south, and west, and the entire perimeter of Muharraq (Ministry of Housing and Planning, 2000). These reclamation processes were concentrated around these remote villages: Busaiteen, Dair, Semaheej, Galali, and Arad, in addition to the Bumaher Islands and Hed in Muharraq Island. The reclaimed areas were later linked together by a network of roads and ring roads. Nevertheless, villages in the vicinity of Manama and Muharraq have been gradually engulfed by urban development and have become part of the metropolitan city. A new road network that links the remote villages to the growing capital also emerged. Some of these absorbed villages surrounded new, planned areas with a grid pattern that provided direct accesses from roads. There are radical changes in urban structures and land uses from the 1930s to 2007. By 2007 the appearance of the new area was apparent in newly developed and sizable sites such as Bahrain Financial Harbour, Durrat al-Bahrain, Amwaj, and Lulu Island, basically located on the coastline. Most of these projects are developed on reclaimed plots extending into the sea. One consequence of the reclamation process in the north is the shrinkage of the area of Bahrain Bay between Manama and Muharraq that is at present linked by three bridges. Another consequence is the increasing density of new developments surrounding these absorbed villages, increasing the chances that a number of remote villages will soon be engulfed in the city's fabric. Some of these absorbed villages by Manama and Muharraq cities have turned into smaller patches within this new urban development. The ongoing land reclamation for these new mega projects on the periphery and the engulfment of villages has turned the urban fabric into a number of small fragmented patches. At present the informal settlements like the absorbed villages in the city's fabric have added to the city's stress due to huge investments in construction along the northern part of Bahrain, especially Manama and Muharraq cities. It follows from the above that differences in tension arise between the global and local properties of Manama and Muharraq structures as villages are absorbed into their fabrics. This will be better clarified after analyzing the cities' spatial patterns by space syntax methodology.

The research methodology

Space syntax provides techniques for analyzing cities as networks of space, and is an approach to organizing urban data structures in space across scales, from micro to macro, relating spatial patterns to functional patterns. This involves other patterns such as movement, land use, and even social well-being. There is an additional dimension to this methodological choice. The model of the city created by space syntax theory can allow the use of two measurements demonstrating relationships in the city: to-movement, which relates how it was built, and through-movement, which predicts movement through spaces (Hillier, 2007). Both of these types of relational patterns can be weighted by different definitions of distance: metric distance, giving a picture of the city as a system of shortest paths; topological distance, giving a picture of the city as a system of fewest turns paths; and geometrical distance, giving a picture of the city as a system of least angle path changes (Hillier, 2007).
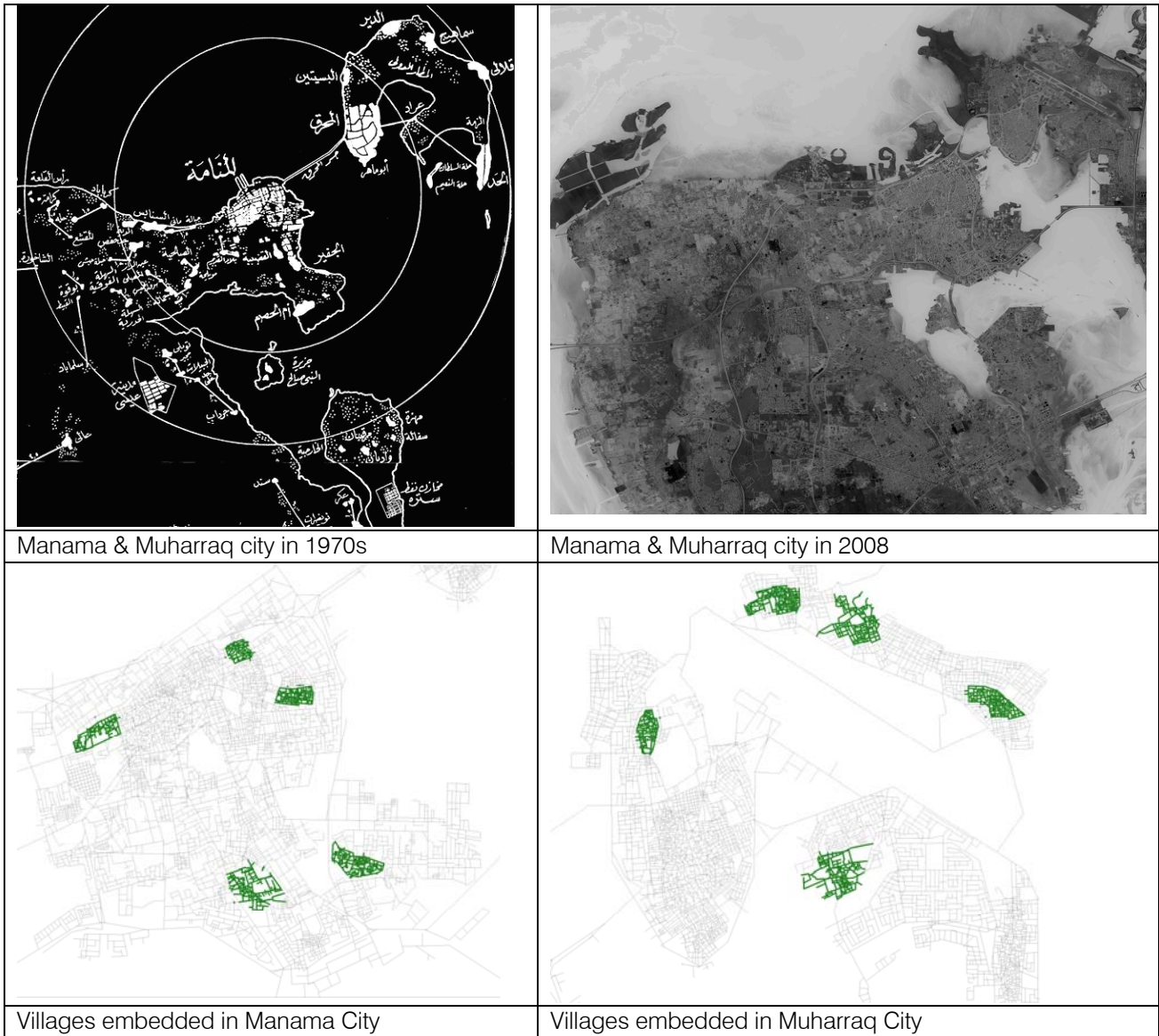
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002:3

| Manama & Muharraq city in 1970s | Manama & Muharraq city in 2008 |
| Villages embedded in Manama City | Villages embedded in Muharraq City |

Figure 1

Manama & Muharraq cities map between 1970's and 2008

It was found in previous syntactic study of informal settlements in Santiago (Hillier et. al 2000; Greene, 2001) that settlements which were well-embedded in their local contexts developed commercial activity on their edges rather than within the settlements. This was considered the most powerful single factor affecting the degree of the city's consolidation, with greater social development and better security. However, what has not been discussed are the relationships between the local–global contexts of local areas such as these villages, and how they are related to a city's fabric. Therefore this paper will focus on the spatial dimensions of the commercial activity within the villages absorbed by the cities of Manama and Muharraq and their relationships to the cities' fabric. This is the key issue, theoretically as well as practically. Fully understanding this relationship entails answering three critical questions: Does the commercial activity on the streets in the ten villages of Manama and Muharraq differ in configuration and scale? If yes, what is the level of the differences? Do the commercial activities relate to the local or global structures of the city or both? Are the commercial streets of the villages part of the context or are they separate?

The Morphology of Exploration

Looking at the case studies of ten villages in Manama and Muharraq, we found approximations of the two theoretical extremes. At one extreme are the village's commercial streets, which tend to be embedded in the main route of the city with high numbers of retail activities. These impose strong rules in the pattern of movement, and are easy to discover when moving in the city. At the other

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002:4

extreme is the case in which the commercial streets are hidden in the local streets, with few numbers of retail activities scattered inside the village. In addition some of the commercial streets of the villages are very close to the souk, the old city centre, and some are very remote from the souk. We have already recognized that some commercial activities seem to occur on local streets and others on more globally located streets close to the main route of city fabric. This might suggest that the commercial streets of the villages will differ in spatial types.
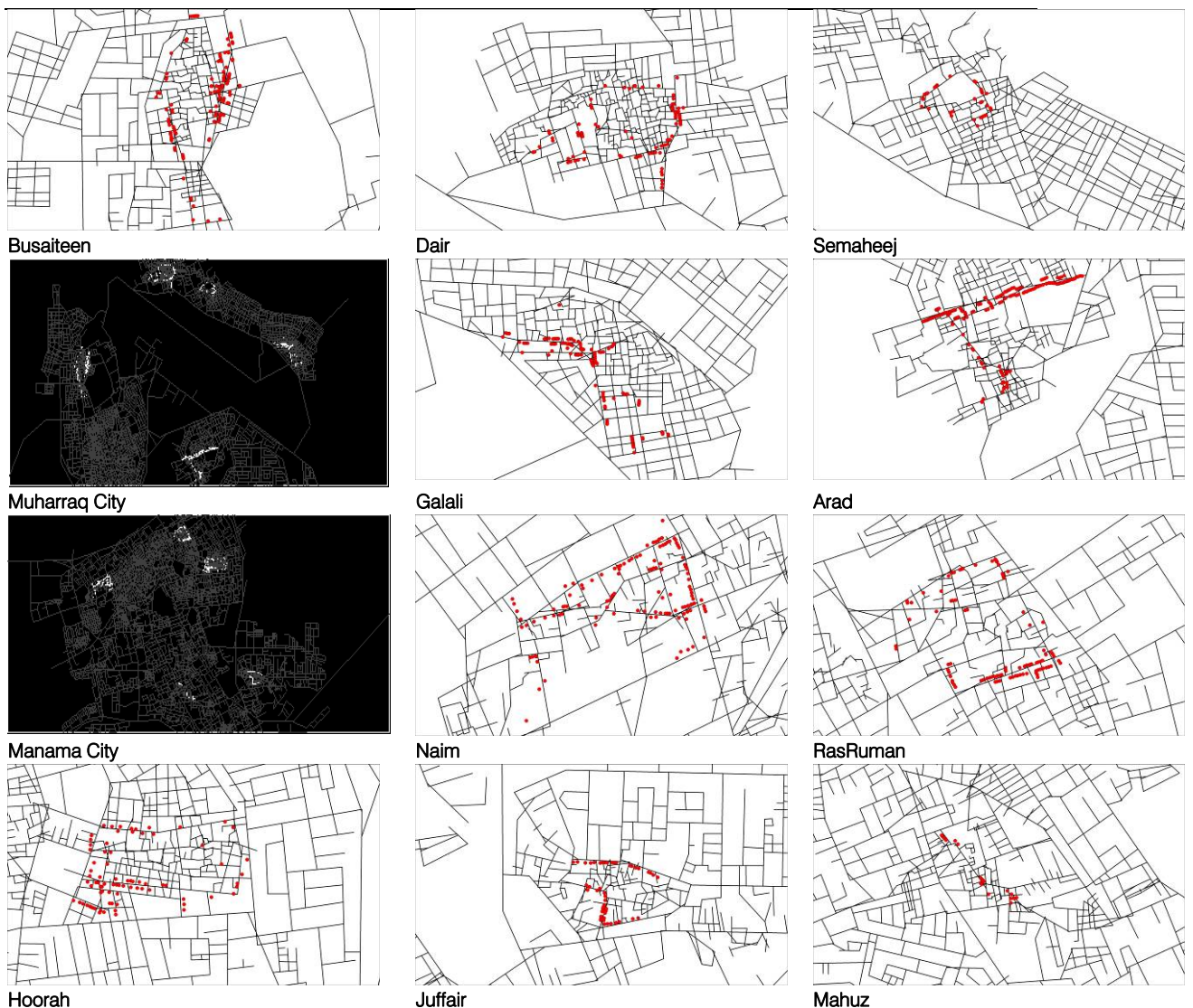

Busaiteen   Dair   Semaheej
Muharraq City   Galali   Arad
Manama City   Naim   RasRuman
Hoorah   Juffair   Mahuz

Figure 2
The commercial activity on the absorbed villages by Muharraq (the first five in the top) and Manama cities (villages maps order clockwise from their location in the city)

To make the differences of underlying villages' commercial activities' spatial structure visually clear, we suggest representing villages' land use by calculating the ratio between commercial activity and non-commercial activity as a figure. Let us look first at the basic demography data of the villages. The table below (Table 1) shows the villages' demographics, basic data such as population, area, commercial building to non-commercial building ratio, Bahraini to non-Bahraini ratio, and low income to high income ratios of the ten villages. Initially the ratios of the three different factors show differences between the villages. For example, Busaiteen village in Muharraq and Naim in Manama hold the highest number of commercial buildings compared to non-commercial buildings in the village, while the village of Hoorah in Manama has the lowest commercial-non commercial building ratio. Also it is considered the village with the highest number of non-Bahrain inhabitants, contrary to the village of Dair in Muharraq which has the highest number of Bahraini inhabitants. Additionally, the highest number of low income inhabitants is found in the villages of Arad and Semaheej in Muharraq city, while the village of Galali had the

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002:5

lowest number of low income people among all ten villages. Generally, the mean number of low income residents is slightly more in the villages of Muharraq than the villages of Manama. Also, the population in Muharraq is slightly higher. The number of Bahraini inhabitants is almost the same in the cities' villages. However, the number of non-Bahraini inhabitants is much higher in Manama, almost three times that of the Muharraq villages. Therefore the ratio between non-Bahraini to Bahraini residents in Manama village is higher than Muharraq.

Village	City	Pop 2007	Area (hac)	CommBldg - NCmm Ratio	Bhr-NBhr Ratio	Low-Hi Incm Ratio	Ttl Ratio	DF
Arad	Muharraq	3178	91	0.475	4.56	0.233	5.27	0.072
Busaiteen	Muharraq	3997	18	0.255	1.22	1.779	3.25	0.045
Dair	Muharraq	7088	105	0.599	20.74	2.972	24.31	0.333
Galali	Muharraq	3557	52	1.089	4.52	4.241	9.85	0.135
Hoorah	Manama	12678	57	4.345	0.24	0.508	5.09	0.070
Juffair	Manama	2681	42	0.831	2.11	0.508	3.45	0.047
Mahuz	Manama	3208	45	1.764	1.27	0.508	3.54	0.049
Naim	Manama	3488	44	0.311	0.97	1.780	3.06	0.042
RasRuman	Manama	10992	38	1.913	0.38	1.778	4.07	0.056
Semaheej	Muharraq	4549	164	1.018	9.60	0.449	11.07	0.152
Total		55416	656	1.000	1.13	1.00	72.966	1

Pop 2007 = Population year 2007; **Comm Bldg** = Commercial Building; **Non Comm Bldg** = Non; Commercial building; **Bhr –NBhr ratio** = Bahraini to Non Bahraini ratio; **Low – Hi Income ratio** = Low Income to High Income ratio; **Ttl Ratio** = Total Ratio; **DF** = Differences

Table 1
The villages absorbed by Manama and Muharraq basic data demography of population , area (hector) , ratio of Commercial Building to non commercial buildings , ratio of Bahraini to no Bahraini and ratio of low income number of people to High income

Village	City	Segm no.	Segm Comm no.	Total Comm Bldng %	Total Ncomm Bldng %	SgmCmm no.- SgmNCmm no. Ratio	SgmLNCmm- SgmLCmm Ratio	Axial LNCmm- AxialLCmm ratio
Arad	Muharraq	714	57	19.23	9.135	0.90	1.25	0.916
Busaiteen	Muharraq	636	72	14.71	3.744	0.863	0.92	1.024
Dair	Muharraq	891	59	9.95	5.963	0.581	0.97	0.692
Galali	Muharraq	789	53	13.24	14.413	0.942	0.95	0.943
Hoorah	Manama	508	56	6.67	29.001	0.984	0.82	0.792
Juffair	Manama	460	26	5.54	4.604	1.558	0.76	0.686
Mahuz	Manama	618	17	2.38	4.192	0.680	1.86	1.761
Naim	Manama	312	54	13.24	4.119	2.467	0.69	0.967
RasRuman	Manama	404	44	10.63	20.340	1.763	1.00	1.224
Semaheej	Muharraq	700	21	4.41	4.490	0.761	1.06	1.376
Total		6032	459	**100**	100	1	1.00	1

Segm no. = Segment numbers; **Segm Comm no.** = Segment Commercial number; **SegmLNCmm – SgmLCmm Ratio** = Segment Length Non commercial to Commercial Ratio; **Axial LNCmm- Axial LCmm ratio** = Axial Length Non commercial to Commercial ratio

Table 2
The profile of the spatial aspects of land uses in villages of Manama and Muharraq cities, (total Segment no., Commercial Segment no., Commercial & non Commercial building % , Commercial Segment – Non Commercial Segment ratio, Commercial Segment length – Non Commercial length ratio, Commercial Axial Length – Non commercial Axial length ratio

So let us now closely examine the villages to explore the differences and similarities of basic geometric and syntactic data. The next table above (Table 2) shows the ten villages of Manama and Muharraq cities, and calculates the ratio between commercial activity segments and the

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002:6

non-commercial activity segments in number and length. A spurious finding is that Dair village in Muharraq had the biggest amount of commercial activity (59), and the smallest ratio between commercial and non-commercial segment ratios. Also Busaiteen village had the highest number of commercial activity among all the ten villages but its ratios were in the average range. On the contrary, Naim and RasRuman in Manama had the highest ratio between the commercial segment amount and the non-commercial segment. The villages of Arad, Galali, and Horah are almost similar between the number of commercial and non-commercial segments (=1). Furthermore the smallest ratios between segment lengths of commercial activity to non-commercial activity are found in Naim and Juffair, while the highest ratios are found in Mahuz and Arad. Semaheej and RasRuman have equal ratios between commercial segment length and non-commercial (=1). Geometrically, the villages of Muharraq and Manama had an almost identical mean number of shops per commercial segments. The mean segment connectivity for commercial is almost identical in the two cities' villages, but is slightly higher in Muharraq. Also the segment length of commercial is very close in the two cities' villages, but the non-commercial segments are longer in Muharraq. The axial lines for commercial are longer in Manama's villages. However the non-commercial axial lines in the two cities are identical. The mean commercial lines are much more integrated in Manama, as well the non-commercial lines. Additionally, the number of segments in the Muharraq villages is more than Manama's. Therefore, there is distinctive geometry associated with the difference between the commercial activity and non-commercial segment number and length. This suggests that we can expect to find simple relationships between the syntactic measures that index commercial properties. And additionally, the expectation is that villages' commercial activity will come in different spatial types.

Do villages' land use relate to local or global?

So let us now turn to a close examination of the syntactic dimensions of the villages to see the common spatial aspects between them and what the critical implications of the different interpretations of them are. The syntactic analysis of the spatial configuration of the villages within the city's context may assume a variety of key by how their commercial activity relates to the city's context. The relationship between the spatial variables that predicts local and global movement, are defined by using 'through movement' choice measures at local and global radii of the villages' commercial activity segments only. We will use the scattergrams used in regression graph, for angular choice at a radius of 500, 700, and 1,000 meters for the local variable, and the same at 2,000 meters as the global variable, by taking the average values. The axial map was drawn in the cities of Manama and Muharraq (Figure 5). DepthMap is utilized to draw the axial map which creates a segment map using segment angular analysis. The specific variables used will be Choice (CH), also known as "betweenness" at different metric radii. "The measure is interpreted as 'through-movement' which tends to be the number of n-steps that a person makes in order to go from an origin to a destination, which predicts movement through spaces, is likely to be more critical than integration, is evolving from the pattern of construction" (Hillier an lida, 2005& 2007). The micro-economic data, which in this case represents the location and distribution of retail shops, was obtained from field surveys of 2006. Finally the retail data will be combined with the syntactic data using the segment line as the unit of analysis and the shops will inherit the values associated with their corresponding segment lines. Another important aspect of this study is the location of retail sites. Because of the absence of any land use maps of Manama and Muharraq, site observations of the shops where carried out in these ten villages.

Syntactically Choice is measured at different radii from local to global. Radius measures have shown that the mean choice at global level Rn is slightly more in Muharraq's villages in the commercial segment, but in non-commercial segments it is almost identical. And the mean Choice at the local level at radius 500 for the commercial segment is higher in Muharraq, but in the non-commercial segment it is almost similar. Mean choice at radius 700 is higher for Manama's villages at commercial and non-commercial segments. At radii 1,000, 2,000, 2,500, 5,000 and 7,000 Manama's Choice measure is higher than Muharraq's villages in both commercial and non-commercial segments.

More precisely the results are shown in Figure 3 of the scattergram graph for commercial villages' segments at global radius 2,000 vs. commercial villages' segments at local radii 500, 700, and 1,000

Proceedings of the 7th International Space Syntax Symposium
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002:7

meters. The villages' commercial activity cases form clusters in each of the four sectors with global Choice on the vertical Y-axis and local Choice on the horizontal X-axis. The commercial activities of Naim, Juffair, RasRuman, and Hoorah are related both to local and global Choices. Muharraq's village of Arad the commercial activity is related to global but not local, while on the other hand Mahuz's commercial activity is related to local but not global. In Busaiteen, Galali, Semaheej, and Dair the commercial activities are neither related to local nor global.
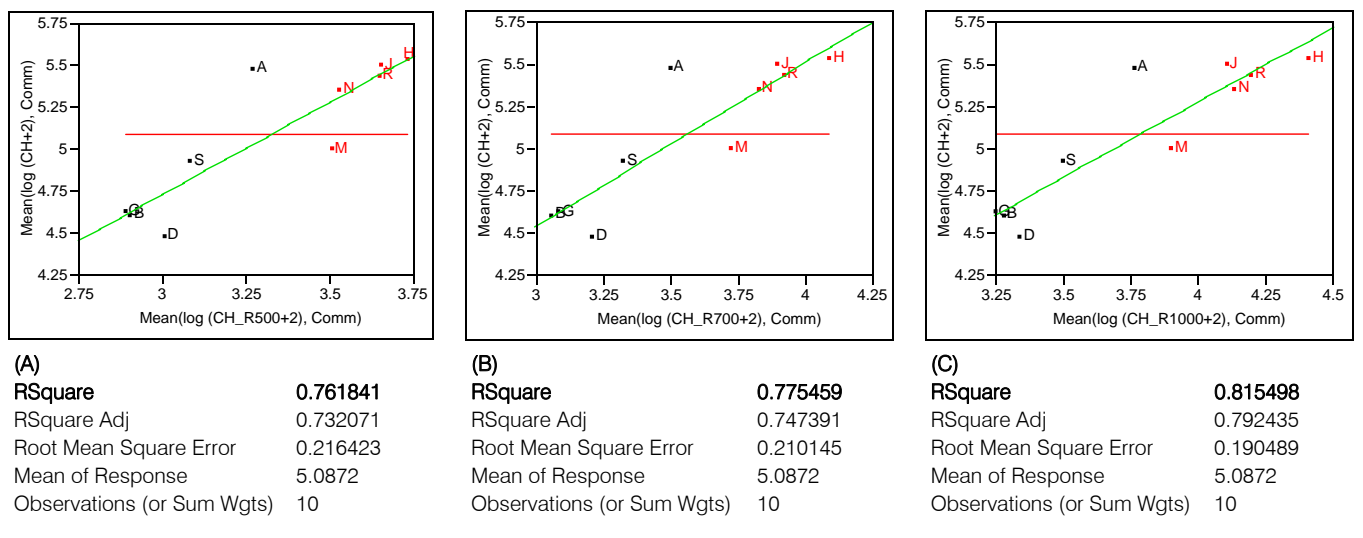

(A)

RSquare	0.761841
RSquare Adj	0.732071
Root Mean Square Error	0.216423
Mean of Response	5.0872
Observations (or Sum Wgts)	10

(B)

RSquare	0.775459
RSquare Adj	0.747391
Root Mean Square Error	0.210145
Mean of Response	5.0872
Observations (or Sum Wgts)	10

(C)

RSquare	0.815498
RSquare Adj	0.792435
Root Mean Square Error	0.190489
Mean of Response	5.0872
Observations (or Sum Wgts)	10

Figure 3

Scattergram graph for commercial villages segment at global radius 2,000 vs. commercial villages segments at local radii 500, 700, and 1,000 meters

RSquare	0.139133
RSquare Adj	0.031525
Root Mean Square Error	0.41147
Mean of Response	5.0872
Observations (or Sum Wgts)	10

RSquare	0.155696
RSquare Adj	0.050158
Root Mean Square Error	0.407492
Mean of Response	5.0872
Observations (or Sum Wgts)	10

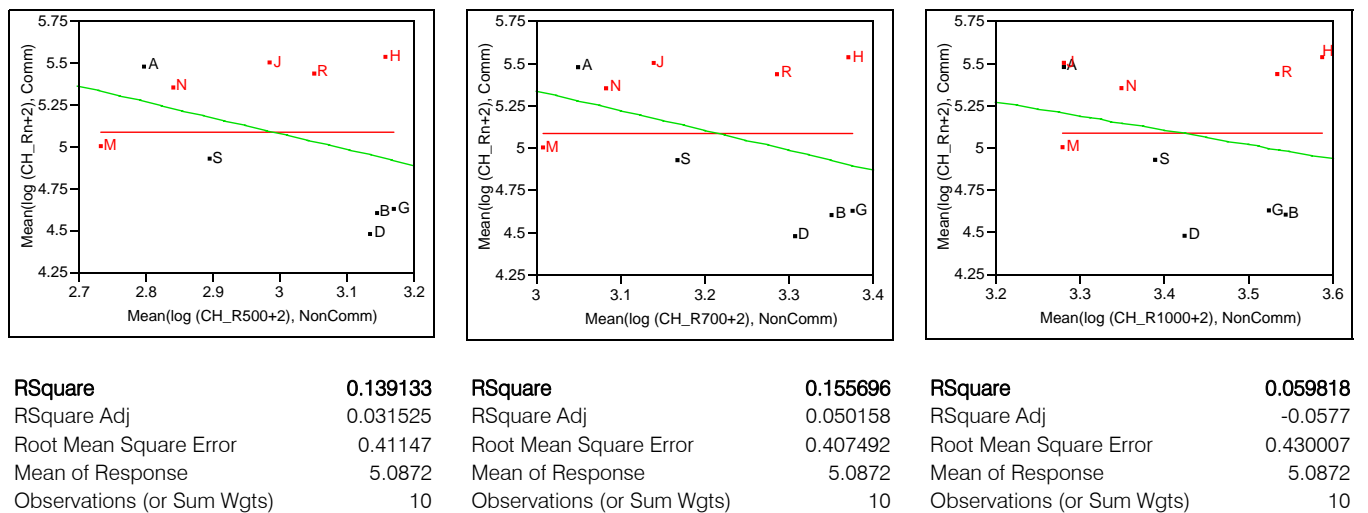|	
RSquare	0.059818
RSquare Adj	-0.0577
Root Mean Square Error	0.430007
Mean of Response	5.0872
Observations (or Sum Wgts)	10

Figure 4

Scattergram graph for commercial villages segment at global radius 2,000 vs. non-commercial villages segments at local radii 500, 7,000, and 1,000 meters

Alternatively, a study of Choice measurements at different radii from the local to global radius for commercial vs. non-commercial segments of Manama and Muharraq villages (Figure 4) have shown that the non-commercial activities of Dair, Busaiteen, and Galali are related to neither the local nor global commercial segments. In Manama's Hoorah and RasRuman the non-commercial segments are related to local and global commercial activities. The non-commercial segments of Arad, Naim, and Juffair are related to global commercial segments and not to the local while the non-commercial activities of Semaheej and Mahuz are related to local but not global commercial activities. The results show a significant difference of the villages' land use (commercial and non-commercial) in relation to local and global syntactic measures.

Proceedings of the 7th International Space Syntax Symposium
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002:8

In short it seems in RasRuman, Arad, and Hoorah the commercial and non-commercial activities are related to local and global. Arad's commercial and non-commercial activities are related to global but not local, while Mahuz's commercial and non-commercial activities are related to local. Also in Busaiteen, Dair, and Galali the commercial and non-commercial activities are related to local. The three villages of Naim, Juffair, and Semaheej have different relationships between commercial and non-commercial segments. In Naim and Juffair the non-commercial activities are related to global, while the commercial activities are related to local. In Semaheej non-commercial activities are also related to local but commercial segments are related to global. Does this then imply that some of the villages' commercial activities can be distinguished from their context and others are more a part of their context?

We will possibly examine the spatial values of the commercial segments by expressing them as a ratio against the average for the 700 metric local contexts. It found that at 500 meters the commercial values are 3.3 times the contextual values. At 700 meters they are 3.5 times the contextual values, and at 1,000 meters they are 3.8 times the contextual values. At 2,000 meters they are 4.2 times the contextual values, and this is more or less the case in each village's commercial segments taken separately (see the following mean values).

Therefore, the commercial segments are sharply distinguished spatially from their surrounding contexts and the differences become more marked with increasing radius. By comparing the commercial segments to their local and global contexts we find how distinct the villages' commercial activities are from their contexts: the higher the value is the more the commercial activity in the villages is sharply differentiated from its context; while the lower the value is the more the commercial activity is part of its context. If we plot the villages' commercial activities using the variable for the R2000 meters radius at global, we find the following order of values:

villages	City	Mean(log (CH_R2000+2), Comm)	EOCA	EOCA - CCH R2000 Ratio
Mahuz	Man	4.262	0.251	0.015069
Semaheej	Muh	3.865	0.868	0.05211
Hoorah	Man	4.875	1.114	0.066879
Juffair	Man	4.556	1.357	0.081467
RasRuman	Man	4.637	1.36	0.081647
Galali	Muh	3.447	1.371	0.082308
Dair	Muh	3.577	1.831	0.109924
Naim	Man	4.597	2.307	0.1385
Arad	Muh	4.234	2.319	0.139221
Busaiteen	Muh	3.798	3.879	0.232875
	Total	4.185	16.657	1

Mean (log (CH_R2000+2), Comm) = Mean Log Choice Radius 2000 for Commercial segments; **EOCA** = Edge of Commercial Activity = 10 (shops/plots) + 10 (edge shops/plots) + (edge shops/shops); **EOCA - CCH R2000 Ratio** = EOCA- Mean Log Choice Radius 2000 for Commercial segments Ratio

Table 4
Mean Choice of villages' commercial segments at radius 2,000 to EOCA ratio

What we found is that the lowest values among all the commercial activities most closely related to their contexts are Galali, Dair, Busaiteen, Semaheej, and Arad villages in Muharraq (all of Muharraq's villages), and Mahuz in Manama. And the villages with the highest values of activities using this measure are Hoorah, RasRuman, Nain, and Juffair in Manama (all Manama's villages except Mahuz). These villages are very distinct from their contexts. If this is the case the strength of the village's commercial activities to context ratio is the strongest correlation with the Edge of Commercial Activity (EOCA) (Hillier 2000)[4] ratio, which was found in a previous syntactic study (Hillier et. al 2000; Greene, 2001) as an influential factor affecting the degree of consolidation (see Table 4).

Proceedings of the 7th International Space Syntax Symposium
Edited by Daniel Koch, Lars Marcus and Jesper Steen, Stockholm: KTH, 2009.

002:9

By comparing the commercial segments at global R2000 metric with EOCA (EOCA-CH R2000 ratio) context we find out how distinct the villages' commercial activities are from their contexts in relation to EOCA. In Table 4 we see that all villages' commercial activities which are significantly distinctive from their contexts have a low value of EOCA, such as the villages of Naim, Hoorah, Juffair, and RasRuman. While some of the villages' commercial activities which are part of their contexts have a low EOCA value such as Dair, Galali, Mahuz, and Semaheej, others have the highest EOCA values as in Busaiteen and Arad in the city of Muharraq. This suggests that the rate of the edge of comercial activities' EOCA's vary in relation to the villages' commercial activities in part of their contexts. The villages' commercial activities which are significantly different from their contexts have a low value.
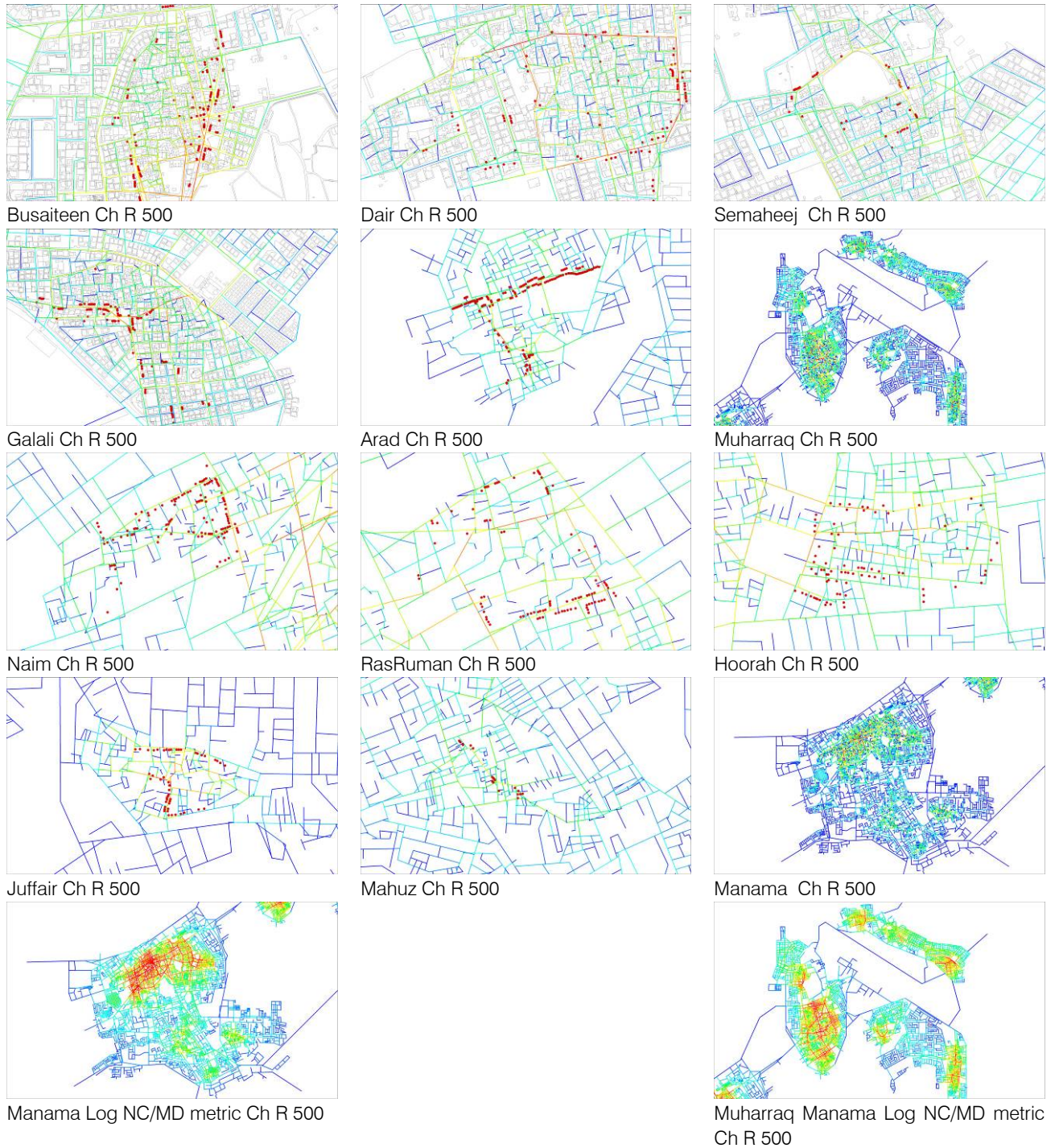
Conclusion

Busaiteen Ch R 500	Dair Ch R 500	Semaheej Ch R 500
Galali Ch R 500	Arad Ch R 500	Muharraq Ch R 500
Naim Ch R 500	RasRuman Ch R 500	Hoorah Ch R 500
Juffair Ch R 500	Mahuz Ch R 500	Manama Ch R 500
Manama Log NC/MD metric Ch R 500		Muharraq Manama Log NC/MD metric Ch R 500

Figure 5
Choice measures at local radius 500 for the villages in the cities of Manama and Muharraq

Proceedings of the 7th International Space Syntax Symposium
Edited by Daniel Koch, Lars Marcus and Jesper Steen, Stockholm: KTH, 2009.

002:10

In conclusion, in this paper we first looked at the geometric differences between the commercial activities and non-commercial activities in the ten villages of Manama and Muharraq. We found there are differences in the geometry associated with the land use in the segment number and length in the villages absorbed by the cities of Manama and Muharraq. This suggests we should not expect to find a simple relationship between syntactic measures and the villages' commercial activities. It also suggests there are different commercial spatial types among these ten villages. The syntactic analysis of the villages show that most of the villages are related to local or global or sometimes both in relation to village land use (commercial and non-commercial). The only exceptions are the three villages of Naim, Juffair, and Semaheej. They demonstrate a different relationship between commercial and non-commercial segments in each village. In Naim and Juffair the non-commercial activities are related to global, while the commercial activities are related to local. In Semaheej the non-commercial activities are also related to local but commercial segments are related to global. Which raises the next question: Does this then imply that some of the villages' commercial activities are part of their contexts and others are different from their contexts?

What we found in this study is that all the commercial activities which were most closely related to their contexts were in Muharraq's villages as well as Mahuz in Manama. And the villages that were distinct from their contexts were all in Manama's villages, except Mahuz. If this is the case, how does this ratio between being a part of and standing apart from the context affect the city's structure? One of the key factors that could be part of the answer is the EOCA. Does the strength of the villages' commercial activities to context ratios have a strong Edge of Commercial Activity (EOCA) rate? The study found that all the villages' commercial activities which are distinctive from their contexts have a low EOCA value. In contrast, some of the villages' commercial activities which were part of their contexts have a low EOCA value, and others had the highest EOCA values. This suggests that the rate of edge of commercial activities doesn't indicate how villages' commercial activities are related globally as a part of or distinct from their contexts. In addition, a more significant question is how these commercial activities are related to contacts from local to global? This might suggest that the EOCA ratio may have no influence on the villages' commercial activities in one which are separate from their contexts. Nevertheless, the EOCA ratio could strengthen the other types of villages' commercial activities when they have been part of their contexts and encourage them to be more embedded beyond their local contexts. This suggestion needs to be tested and investigated in a future research study.

Notes

[1] The pan of Arabian universities countries, the institution of research and studies 1975.

[2] Researchers call these novel land use patterns desakotas ("city villages") McGee, Terry (1991), Zwischenstadt (in-between-city) Sieverts, T. (1997), in situ & peri-urban; they argue about whether they are transitional land or dramatic new species of urbanism.

[3] Early maps that go back up to 1860 and 1872 (Jarman 1996), show the domination of types of land use.)

[4] It is based on the formula indicated by Hillier et. al (2000, Page 88): EOCA = 10 (shops/plots) + 10 (edge shops/plots) + (edge shops/shops)

References

Arab League. 1975. State of Bahrain: A study of environment challenging and Human, (in Arabic), the Institution of research and studies, Cairo, Egypt

Archive Editions. 1993. Bahrain Government Annual Reports (BAR) 1924-1970 8 Volumes, London,

Archive Editions. 1993. Records of Bahrain (RB); Primary documents 1820-1970, (8 Vols).

Ben-Hamouch, M. 2004. The Changing Morphology of Gulf Cities: The Case of Bahrain. Habitat International Vol. 28, 521-540.

Ben-Hamouch, M. 2007. Land-use change and its impact on urban planning in Bahrain a GIS approach, Middle East spatial technology 4th conference, Bahrain Kingdom

David Drakakis-smith, *Third World Cities*, p. 21

Douglass, Mike. 1998a. A Regional Network Strategy for Reciprocal Rural-urban Linkages. An Agenda for Policy Research with Reference to Indonesia. In *Third World Planning Review,* Vol. 20, N°1.

Proceedings of the 7th International Space Syntax Symposium
Edited by Daniel Koch, Lars Marcus and Jesper Steen, Stockholm: KTH, 2009.

002:11

Fuccaro N. 1999. *Urban history of Bahrain*. Excess University

Fuccaro , Nelida. 2005. Mapping the Transnational Community: Persians and the Space of the City in Bahrain, c. 1869-1937. In *Transnational Connections and the Arab Gulf,* ed. M. Al-Rasheed. Routledge, pp. 39-58.

Fuccaro, Nelida. 1999. Islam and Urban Space: Ma'tams in Bahrain before Oil. *Newsletter of the Institute for the Study of Islam in the Modern World* (ISIM), 3. 12.

Fuccaro, N. (2000). Understanding the urban history of Bahrain. *Journal for Critical Studies of the Middle East*, 17, 49–81.

Greene, M. 2001. Housing and Community Consolidation in Informal Settlements: A Case of Movement Economy. J. Hanson (Ed.), *Proceedings*, 4th International Space Syntax Symposium. London: University College London.

Guldin G. 2001. *What's a Peasant to Do?: Village Becoming Town in Southern China*. Westview Press, Boulder 2001, 312 pp

Hillier, B. 1999. Centrality as a process: accounting for attraction inequalities in deformed grids. *Urban Design International*, 3/4, 107-127

Hillier, B. (2001a) A theory of the city as object: how spatial laws Proceedings of the Third Space Syntax Symposium, Atlanta available at, mediate the social construction of urban space

Hillier, B. & J Hanson. 1984. *The Social Logic of Space.* Cambridge: Cambridge University Press

Hillier, B. 1996a. *Space is the Machine.* Cambridge: Cambridge University Press. 470-

Hillier, B. 1996b. Cities as movement economies. *Urban Design International* Vol 1 No 1 pp49-60 E & F.N.Spon

Hillier et al. 1987. Creating life: or, does architecture determine anything? *Architecture & Behaviour* Vol 3 No 3 pp 233-250.

Jarman R. 1996. Historic Maps of Bahrain 1817-1970 London, Archive Editions.

Jones, G.W. & P. Visaria (eds.). 1997. Urbanization in large developing countries, China, Indonesia, Brazil, and India. Oxford: Clarendon Pres.

Khuri F. (1980) Tribe and State in Bahrain University of Chicago Press.

van den Berg, L., M. van Wijk, and Pham Van Hoi. "The Transformation of Agricultural and Rural Life Downstream of Hanoi"

Li, Jing Neng. 1997. Structural and Spatial Economic Changes and their Effects on Recent Urbanisation in China. In *Urbanisation in Large Developing Countries: China, Indonesia, Brazil, and India,* ed. G W Jones and P Visaria. Oxford: Clarendon Press.

Lorimer J.G. 1986. Gazetteer of the Persian Gulf, Oman and Central Arabia, Government of India 1908 & 1913, 4th Edition, (8 vols.), London , British Library Cataloguing in Publication Data.

Mandeel, F. 1992. *Planning regulations for the traditional Arab-Islamic built environment in Bahrain.* M.Phil. thesis, University of Newcastle-upon-Tyne, unpublished.

McGee, Terry 1991. The Emergence of Desakota Regions in Asia: Expanding a Hyopthesis. In *The Extended Metropolis: Settlement Transition in Asia*, edited By N. Ginsburg, B.Koppel, T.G. McGee. Honolulu: University of Hawaii Press. 3-25.

McGee. T. G. 2003. The Emergence of Desakota Region in Asia Expanding a Hypothesis. In *Cities Without Cities: An Interpretation of the Zwischenstadt*, ed. Thomas Sieverts, 3. London.

Ministry of Housing (MOH). 1986a. Bahrain yesterday and today. Manama. Bahrain: Ministry of Housing, Arabian Printing & Publishing House.

Ministry of Housing (MOH). 1986b. Development of dwelling units. Manama. Bahrain: Ministry of Housing, Arabian Printing & Publishing House.

Ministry of Housing (MOH). 1987. Manama urban renewal project. Manama: Physical Planning Directorate.

Ministry of Housing (MOH). 1996. Housing and urban development. Manama. Bahrain: Ministry of Housing, Arabian Printing & Publishing House.

Mora, R., 2003, "Informal Economy and Spatial Configuration in Quilicura, Santiago", J. Hanson (Ed.), *Proceedings*, 4th International Space Syntax Symposium, University College London.

Ranjith Dayaratne and Raja Samarawickrama, "Empowering Communities: The Peri-Urban Areas of Colombo". *Environment and Urbanization* 15: 1 (April 2003)

Rumaihi M.G. (1976) Bahrain: Social and political change since the first world war London and New York: Boweker.

Sieverts, T. 1997. *Zwischenstadt zwischen Ort und Welt, Raum und Zeit, Stadt und Land*. Braunschweig: Vieweg Verlag.

Proceedings of the 7th International Space Syntax Symposium
Edited by Daniel Koch, Lars Marcus and Jesper Steen, Stockholm: KTH, 2009.

002:12

Wali, T. 1990. *Al Muharraq 1783–1971*. Manama: Panorama Al-Khaleej (in Arabic).

Yarwood, J. R. 1988. *Al Muharraq: Architecture, urbanism and society in a historic Arabian town.* Ph.D. Thesis,University of Sheffield, unpublished.

Yeboah, Ian E. A. 2003. Demographic and Housing Aspects of Structural Adjustment and Emerging Urban Form in Accra, Ghana. *Africa Today* - Volume 50, Number 1, pp. 107-119

Proceedings of the 7th International Space Syntax Symposium
Edited by Daniel Koch, Lars Marcus and Jesper Steen, Stockholm: KTH, 2009.

002:13