Late Bronze Age Mediterranean Urbanism and Depth Map Software: The Cases of Ugarit (Syria) and Enkomi (Cyprus)

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This article is about Urbanism in the Late Bonze Age in the Eastern Mediterranean. We analyze two cities from this region, Enkomi and Ugarit with the help of Space Syntax analytical tools, and then, with the help of the already known archaeological data, we try to reconstruct the correlations between those societies and the formation of their urban space.

Keywords: Urbanization, Agent analysis, Space Syntax

1. Introduction

This paper presents an urban analyses of two Late Bronze Age cities of the Eastern Mediterranean, Enkomi, Cyprus and Ugarit, Syria, by using both traditional archaeological methods as well as new technology. In this case, Depth Map, computer software based on Space Syntax theory, is used to improve understanding of the city's properties and, specifically, the criteria for the placement of buildings and the city's internal circulation patterns. Furthermore we attempt to compare past archaeological results of urban nature with the results of the software analysis and ultimately answer the question of whether social structure can be represented by spatial uses and how.

2. The methodology

The methodology used to approach our research topic is divided into two distinct parts: The archaeological one and one that includes digital applications of Depth map. Those two parts will cover the spectrum of both intrinsic and extrinsic properties of space, meaning that we will address both the visible properties of space and the ones not immediately comprehensible by visual detection. By using the published material and in situ observations, we intend to describe the settlements in terms of properties that are archaeologically recognizable. In addition, we will also focus on the study of the intrinsic spatial properties of the remains. This is very important because the correlation between spatial information and the rest of the archaeological data can be a valuable

source for archaeology, not yet fully exploited. Space syntax theory and its digital applications will be of valuable assistance in this research. The intrinsic properties of space can only be understood when different elements of a city are placed within a common frame of reference and the relationships between them are examined. The program that we have used as a tool for analysis relies on a theory with relatively basic principles (VAN NES, 2008). One such principle is that there is a dialectic relation between society and space and that space is not only the receiver of human actions but can also generate the conditions under which an urban society will develop. What we imply here is not of course "spatial determinism" but more the idea that specific conditions of a built environment particularly encourage certain sorts of activities more than others. The Space Syntax method has more or less three levels to approach space. Firstly, it deals with space as a network based on the placement, grouping and orientation of buildings. On the second level it examines how those networks relate to certain patterns such as the movement within space, land use etc. On the third level it provides data for theories on how cities develop and function as a built environment. The main aim of this kind of analysis is to reveal the interrelations between all possible spaces that constitute a city plan, thus the configuration of space (STOGER, 2008). The program is able to do these things by counting two main properties: the accessibility/visibility potential and the frequent visit potential of every street on the network (VAN NES, 2008). This is done in two ways: by calculating the metric and the topological distance

within the network. Another aspect that is very important for this program is the relation between public and private. The street network is defined as public and the different buildings as private. Through the study of the connections between those elements of the town we can draw conclusions about the nature of a street and of a neighborhood in general. This approach can analyze both the street network as a system on its own, but also in relation to its built environment. In spite of the criticism that space syntax theory applications have received lately (PALIOU, 2008), we consider those applications to be the most adequate for our case studies because they analyze only the ground layout (since we mostly examine the "public space" of the city and its configurations) and not so much the structures of the neighboring buildings or their content.

3. The case studies and their archaeological background

The cities that are going to be examined have been selected according to the following criteria: in both cases the excavated part is significant, as it provides a good overview of the urban development of the town. In both case studies approximately 30 percent has been excavated and a big part of this information has also been published by relevant archaeological teams. The reason why this condition is so important is obvious: It is practically impossible to have reliable conclusions on urbanism unless one studies as many aspects of the city as possible. Furthermore, the application of the Depth Map software requires a fixed area of study. The more limited this is, the more difficult it is to correlate spatial properties. Another reason for the selection of those case studies is the fact that those cities developed and flourished simultaneously but in a very different way. Enkomi is an example of a planned town and Ugarit is a well known example of organic urban development. This condition is also very basic, since different urban plan implies different social organization for a settlement. It would therefore be interesting to see how the digital application would correspond in identifying elements of those different societies. One would expect the program to function properly for the grid-plan Enkomi that resembles closely our modern cities, for which Depth Map is designed for. But it is even more challenging to see the accuracy level of the application on a less straightforward city plan like the one of Ugarit. Both case studies also have many interesting aspects concerning the social relations they imply and therefore Depth Map application will have to be combined with different social approaches for the population of those cities.

Enkomi is the Key site for late Bonze Age Cyprus (DIKAIOS, 1971; COURTOIS *et al*., 1986; KENTH, 2007). The walled city of approximately 300 m. width and 350 m length was constructed nearby the river Pedieos that was connecting the plain with the nearby sea side and its port. According to the finds, the city

served as an industrial center for goldsmithing and as an export port for raw materials and items (KESWANI 1996, 2004). According to archaeologists, the Late Cypriot Period (from the late 16th to the late 11th century BC) is characterized by a gradual involvement of Cyprus into the exchange networks of the Eastern Mediterranean due to its large copper mines (KNAPP, 1986). This necessity created the need for an exchange network that connected the inland mines with the coastal area, which functioned as an ideal place for a port settlement. The intensification of the function of those networks became the force behind the development of various coastal sites into local urban centers with various characteristics. Enkomi is the one of the largest and more thoroughly excavated examples.
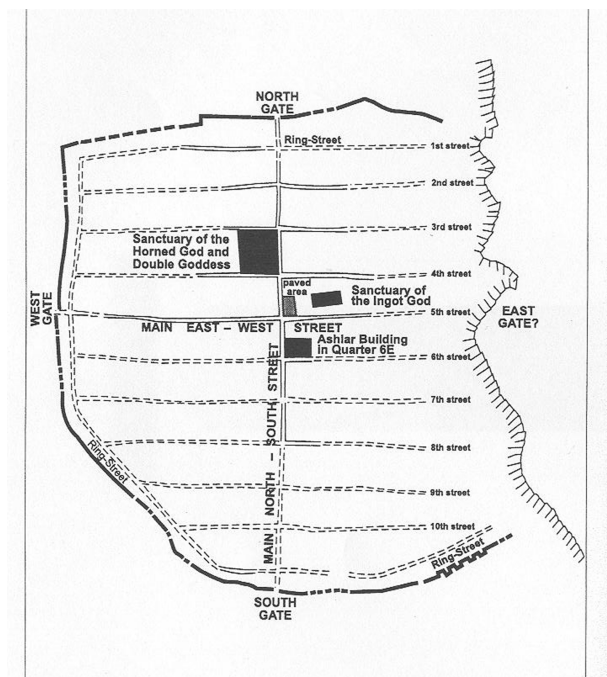

Figure 1: *The excavated and hypothetical parts of Enkomi's layout, with some of the major sanctuaries highlighted. To the east, the city is blocked by low hills. (after WEBB J. 1999).*

The form of the city that is known dates from the 13th century BC and according to some scholars the site was gradually abandoned and destroyed by the late 11th century. What strikes the viewer is the very well planned city grid. The city had one north to south main axis that divided its space in two more or less equal parts. Approximately 12 other streets from east to west form extremely long insulae of about 150 m long and 33 m wide. The walls probably have four gates with only three of them having been excavated to date. There is only one open space in the city, exactly in the middle and so far, no palace has been discovered on the site (KENTH, 2007). The fact that no palatial complex has yet been uncovered, although a large part and central area of the town has been excavated, strongly indicates that the city probably didn't have such a structure. Trial trenches on the periphery of the town also proved very little of the possible existence of such a building. Perhaps what we need in order to comprehend the site

better, is an alternative theory to interpret the city and its financial role for the island. The fact that similar "hegemonic" buildings have been excavated only in the inland centers of Cyprus perhaps indicates that political power and goods exchange were not housed in the same site (KESWANI, 1996). Further observation of Enkomi shows that its insulae have the same land uses like, housing, working spaces, temples etc. The repetition of this similar land use pattern shows the great fragmentation of the local society. The fact that the city had no common space for public activities can only indicate a weak nature of any existing city authority. Pottery analyses together with burial customs show a close connection with the immediate inland of the island and –consequently- the lack of a solid urban identity as far as we can tell from the variety of the finds and the various ways for building temples and burying the dead (WEBB, 1999). It seems to many scholars that the city was always very politically dependant on other inland settlements. It probably never formed its own strong political identity like other sites on the island like Kition (which is several kilometers to the west of Enkomi, under the modern city of Larnaca), where apart from walls, one also observes impressive cult buildings and large open spaces around them. The plan of Enkomi seems to have a very practical use and its main priority was to divide the land in relatively equal plots among various groups. It is also worth nothing that Enkomi seems to be an example of a group of cities erected on Eastern Mediterranean soars, mostly serving as ports for goods and production centers for other political entities of the region like the port of Ras Ibn Hani, subject to Ugarit, on the Syrian coast.

Figure 2: *The excavated parts of Ugarit (after the exhibition guide "La royaume d'Ougarit" Lyon 2004).*

The case of Ugarit is rather different. The city is very well known both from excavations and texts as the capital of the small state to the North Western part of modern Syria. It is a city that has developed over centuries during the second millennium BC but its currently known form dates from the 13th century BC (YON, 1992). Thanks to the wide range of texts surviving from the city we have a great number of information on the social and economical structures of this ancient state and its capital. Ugarit was ruled by a king and his court, who were very active in goods exchange between the Mediterranean and the Middle East. The fertile agricultural land also gave revenues to the state and, according to excavations taking place during the last few decades, there seems to be something that we could call a settlement pyramid, ranging from the capital to small villages all over the landscape. Coastal settlements were very important as ports and there must have also been an extensive bureaucracy for the management of the state, as various private and non private archives prove.

Ugarit is a rather large city organically ordered on a tell with one hill to the North East, where the most prominent temples were placed, one for the God Ball and one for the God Dagan. Those buildings seem to be the oldest structures in the city of Ugarit, as they probably date from the Middle Bronze Age. To the North West we see the large palace that controlled the town's international economic relations. The palace is organized around large courts. The building had at least one more level and the excavations in it have uncovered large numbers of luxury items as well as extensive archive fragments. The non regular shape of the building probably implies that it has more than one construction phase and according to the excavators can be dated from the 14th century BC. The palace is found immediately after one enters the main gate of the city, coming from the Syrian coast. The construction of the palace here and not in another area, such as higher points of the city's landscape, indicates the role of the palace as a regulator of the external exchange relations of the state. Around it, the most luxurious quarter of the town is situated. This part of the city has yealed primarily large houses with impressive finds and constructive technology. Their vicinity to the palace shows clearly the connection between their residents and the ruling family as well as their social role.

To the South we see the main square that joins the main roads from East to West. Although the place is partly excavated one can tell that it is the largest open space of the town and a key point for the circulation within the city. Generally, in Ugarit there is a large variety of open spaces and streets that connect the city's different parts and there seems to be no particularly typical shape for the city's insulae. Houses vary considerably in size and it is not uncommon to find houses divided later on, in order to form smaller ones or uniting with the neighboring ones in order to form larger properties. That shows a dynamic society and perhaps social mobility.

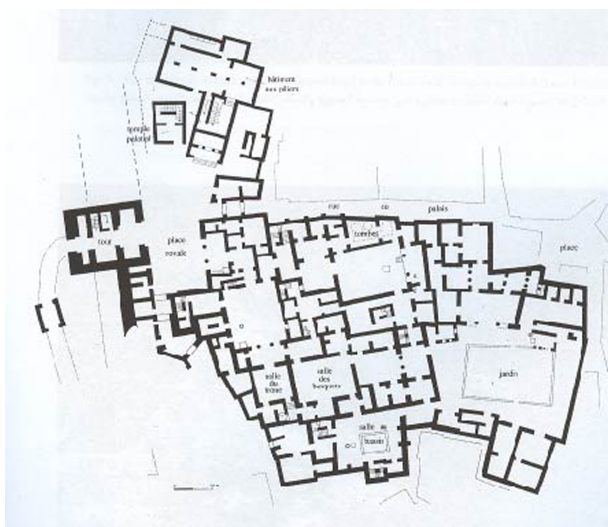Agent-Based Social Simulation in Archaeology

Figure 3: *The layout of the excavated palace of Ugarit in relation with the north-western gate and some other public buildings just to the north of it. (after YON M. 2006).*

Large numbers of the households in Ugarit seam to rely on agricultural production and/or craftsmanship (MACGEOUGH, 2007). There is no zoning in the city of Ugarit and the city seems to function around neighborhoods, exactly as a non industrial city would. The city also had a walled rampart and at least three gates. One of them is excavated at the North Western part, near the aforementioned palace. The city prospered because of the rich agricultural production and because it was the end of the main trading route from Mesopotamia. Its two ports – Ras Ibn Hani and Minet el Beida- were serving the international trade in the Mediterranean, also involving raw metals (VAN SOLDT, 2005). The economy of the city of Ugarit seems to be a more complicated issue, since it was the capital of the Kingdom and by far the largest settlement. Apart from the expected bureaucracy and aristocracy elites, the city consists mainly of typical households that have connections more with the agricultural land than with the lucrative interregional exchange networks of the time. Part of those households were processing land products and also had their own little workshops, perhaps functioning on a more limited scale. Priesthood also makes up part of the city's society but we know very little about the economical role of the temples.

As it has become obvious from the above in the case study of Ugarit we are trying to determine if an already known social structure will correlate with space while in the case of Enkomi, due to the lack of written sources, we will have to rely more on spatial data for our conclusions. In any case, the various archaeological theories about spatial organization in these two cities constitute the theoretical environment in which the Depth map analysis will be evaluated (WHEATLEY, 2000).

4. The application of the Depth Map software on the case studies

During our research we have applied the software on the two case studies after having digitalized the layout of the two cities, having included all the elements available so far, together with reasonable conventions that do have a basis on the excavation data. For the case study of Enkomi, the main problem for the formation of a reliable city map, was the limited excavation data from the eastern part of the wall rampart as well as from a great part of the city. But taking in to consideration the fact that the largest excavated part of the city demonstrates a very symmetrical layout, with fixed sizes for basic elements, like the insulae's or the street's width, it is very reasonable to suppose that it would have being highly improbable for the rest of the layout to follow different patterns. So, with the help of the already excavated area, we have reliably reconstructed the whole plan of the city. As for the wall rampart, it may be that the eastern part is not extensively excavated but nevertheless the existence of the low hill all along that part of the city provides a safe boundary. And finally, the whole direction of the excavated wall rampart shows clearly that those hills were the east boundary of the city.

For the case of Ugarit the basic problem was the fragmentation of the excavated trenches and the large unexcavated territories between the trenches. Fortunately the French team excavating there has produced a reliable map of the whole city that includes the hypothetical but very probable connection of the various existing streets, and thus reconstructing the most important part of the street network of the city. For the rest we have hypothetically extended the existing streets according to the land formation of the tell and the main possible exits of the city. Nevertheless, in the process of forming the digital map we have taken the precaution not to add the supposed streets in total alignment with the excavated ones, in order to avoid the confusion of the digital application, which recognizes any straight line as one street. In this way we have reinsured the proper application of the software and the objectivity of its calculations for the actual excavated part. In the final process of the evaluation of the data we have considered only data from the excavated and most reliable part of the map, integrated within their wider urban context.

From the great number of possible applications we have focused on only some of them (VAN NES, 2008). The first one is the so called "axial analysis" that shows local and global integration, in other words how well connected one street of the town is in relation with all others. Very similar is the "angular analysis", which estimates the relation of one segment with all the others. "Visibility analysis" is another one, which indicates up to what extent, a spot in our towns is visible from the rest of the settlement. We have particularly checked the visibility level of specific spots of each city by performing the "isovist analysis". "Agent based

analyses", which is exactly the simulation of actual human movement within the cities themselves, was also performed. This last application was the most important because it has in a way summarized all the other conclusions to actual movement and accessibility patterns that showed how people actually used the city. Furthermore it brings to the analyses the scale of the individual, as an ultimate verification mean for the analyses produced (WHEATLEY, 2000). Finally we performed the "all lines analysis" that estimates the most likely ways to move within the city. Those applications were performed in order to have some specific answers to some vital questions. For Enkomi, the main research questions the role of the main open space in the middle of the town and the existence or not of an urban focus in the city that would probably have housed the supposed palace of the town. A third question was the existence of neighborhoods in the town that would have a distinct urban feature or not. Other than that, we tried to determine if there is any specific pattern in placing particular buildings like temples within the city. Furthermore, we were very interested in the circulation patterns in this city with the only north to south axis.

To all the above questions the result from the digital applications was very helpful. For the case of the main open space the analyses has showed that this could not have functioned as a square because of its low visibility and accessibility, since while it lies right on the main north to south axis, two out of four of its sides are blocked. In that way the basic argument for having a palace there was totally mistaken.
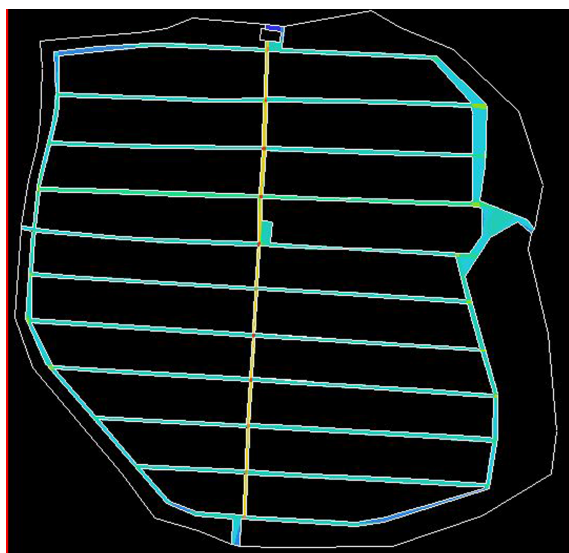

Figure 4: *The Visibility analysis result for Enkomi. It is surprising that the small "square" does not seem to be very visible even form then neighboring streets.*

In the same way, the program has showed that the city is divided in a very egalitarian way and no other place, with the exception on the main north south axis, could have played the role of a civic center for the town's inhabitants.

Figure 5: *The application of agent based analyses in the case of Enkomi. .*

The fact that great part of that axis is already excavated makes the possibility of having a palace there very slim, with whatever consequences that might have for the interpretation of the city's society. As for the neighborhoods, no urban separation within the limits of the town was detected and therefore the neighborhood spirit should be seen within the borders of an insulae rather than the city as a whole. Furthermore, from the circulation pattern that was produced by this analysis, it was proven that only south-north circulation was encouraged, probably because of the need to carry products from the nearby river bed to the inland terrain. The rest of the city is equally accessible, but nevertheless circulation from one east-west axis to another is not particularly encouraged.

For the case of Ugarit the situation was quite different. The excavation is divided in many unconnected trenches (figure 2) and the creation of the map to be analyzed was done with some degree of possibility, but yet not certainty. From this map, only the actual excavated part and its results were taken into consideration and the other areas functioned as a support to the excavated ones rather as an actual case. In this case, among the basic research questions were the function of the various open spaces of the town, which, unlike Enkomi, are dominating the urban net and can be divided into several categories. Apart from the main open space, one counts numerous small open spaces in the junction of smaller or larger streets, open spaces in front of the main sanctuaries on the hill, as well as open spaces in front of various public buildings like the palace. Another important question is the urban role of the excavated palace, which seems to block the easy access to the town by being placed right after the main northwestern gate. A big archeological question is also the nature of the hill neighborhood with the temples. This part of the city was interpreted as a priest's quarter by some scholars, and it would be interesting to examine the position of the two

temples within the urban fabric just to see to what extent they have a central role for the neighborhood. It has been argued that the palace was the cultic center of the town and that the role of the temples was great for the quarter and the town as a whole. The general circulation pattern within the city (YON, 1992) is another interesting topic for which this type of analyses has showed a great deal. Generally the conclusions of the Depth Map analysis, combined always with the solid archeological date are very indicative about the function of the town in antiquity.

Figure 6: *The application of agent analysis in the case of Ugarit..*

The analysis has showed many interesting results concerning the questions above. For the nature of the so called "priest's quarter" the application has showed that this is probably not the true nature of the place since it has restricted accessibility from the rest of the town. Moreover, the two aforementioned temples are not built on the main local street of the quarter which seems to pass one block to the south west of the position of the temples. In other words, those buildings are not the focus of the quarter and they probably serve basically a local role. The fact that they are placed on the highest part of the hill definitely gives them visibility and perhaps a symbolic meaning for the cityscape but its function seems to have been rather restricted, the access was restricted to the small open spaces in front of them.

The analysis has also showed that the city was consisting of smaller neighborhoods that are focused on the street junctions. Those various neighborhoods have been spotted around the town, and are basically those that the main street network connects. The placement of the palace as the main focus of the town shows its important role, as it controls the access to the town from the ports. That confirms the privileged access that we know that the palace has in the international markets and the luxury goods trade of the period. The same applies to the palatial quarter whose residents were in close

Figure 7: *The All Lines Analysis result which shows the most popular way to move within the walls of Ugarit. The so called "priest's neighborhood" (top right) does not seem to have the temples as a focus, since they lie away from the highlighted main street..*

connection with the ruling elite. The gradual development of the palace within the frame of a couple of centuries probably can be interpreted as the gradual control of this ruling elite over the overseas trade and the wealth deriving from it. The main circulation pattern was probably from the North Western gate to the rest of the town, although the connection between this palatial quarter and the rest of the city remains poorly understood. The rest of the town seems to be better connected with the other exits of the rampart, the ones leading to the countryside; something which supports the analysis for the household economy of Ugarit. There seems to be satisfactory interconnection between the various neighborhoods. Within this frame, open spaces seem to have a great local role, probably the focus of the neighborhood, while only a few of them seem to reflect on the entire town. It is nevertheless very significant to see the clear social function of the open spaces in Ugarit while in Enkomi the nature and design of the limited public space does not seem to encourage social interaction. Ugarit, as a result of development through the centuries, is a city whereits parts are better integrated and more interactive towards the open spaces, while Enkomi adopts a very rational plan but does not seem to reflect the actual needs of the inhabitants. The plan of Ugarit gives the pedestrian more options of turning, and for the city planning theory this is considered a basic parameter for the human scale of a settlement and encouragement of neighborhood life (STOGER, 2008).

Conclusions

From the above applications it has become evident that the space syntax analyses and the depth map software in particular have a lot to contribute to archaeological work

as long as it is used wisely, and as long as three very important conditions are met: First, we need to have a representative sample of the city excavated, both in terms of quantity and of quality. Then, this data needs to be published so that we can compare it with the digital results, and finally one needs to know precisely what the program can or cannot indicate, and form the research questions in the most precise way possible. Generally, both applications have been successful, and for most aspects in accordance with the archaeological data. Our method, combined with the application of the depth map software, has proved great performance in both planned and organically developed cities. Critical process of the data can be a great contribution to the archaeological questions formed about each town.

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