Application of space syntax to the study of the housing in the Phoenician–Punic era in the central sphere of the Mediterranean

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Abstract

This paper presents a large part of the results of a doctoral research entitled ‘Syntactic modelling of the city and housing in the Phoenician-Punic era in the central sphere of the Mediterranean’. It constitutes a contribution in the field that formalizes the fundamental and complex link between architecture and society and as its title states; it combines and crosses two disciplines, archaeology and architecture.

Mainly, this paper focuses on the urban dwelling in the Carthaginian territories along its natural borders and its political expansion in the central Mediterranean and during the first millennium BC. It apprehends domestic architecture as one of the most expressive reflections of the collective identity and the personality of a culture and considers that the house carries cultural information in its form and its space configuration and has the merit to inform about social and symbolic aspects of this occult civilization that suffers from a documentary deficit, partiality and lack of objectivity of literary sources. Our main purpose is to try to understand if these houses could maintain, at the level of their spatiality and visibility, a unity that could identify them respectively as an architectural genotype.

The application of the syntactic approach (permeability and visibility analyses) to the study of an exhaustive sample of urban houses from several Phoenician-Punic territories (185 urban dwellings in all, from the African-Punic territory – Carthage metropolis and Kerkuane Punic City –, Sicily – the Punic dwellings of Selinunte – and Sardinia – Monte Sirai Phoenician-Punic city) allowed to detect the spatial and visual logic and to confirm the famous historical passage of the ancient geographer Strabon. The latter postulates that the existence of a certain number of distinctive Phoenician-Punic morphological characters. The study allowed to achieve a typological classification of canonical types of Phoenician-Punic houses; to identify their functional, spatial and visual organization based on a strong dichotomy between private and public domain; to deduce the common and repetitive organizing principles that give this domestic architecture its particular identity (its genotype); to establish the relation between the symbolic aspects related to this kind of spatial organization which is expressed by a repulsive faculty, segregation, privacy and dominance; and finally to state some previews on this society, which gains on segregation and folds on itself. These results corroborate some findings of archaeological research and historical discourse suggesting that this culture, despite the fact that it succeeded in marking humanity by its many inputs that had contributed to Africa’s conversion and integration into the Mediterranean had failed to challenge and accept the other.

Keywords

Phoenician–Punic domestic space, household archaeology, permeability graph analysis, visibility graph analysis, socio-symbolic expressions and socio-cultural dimensions.
1. INTRODUCTION

Space is ‘a language that structures, organizes and explains the world, in the sense that it constitutes a global system of representations in which authorities, society, family, individual, national values and cosmos are illuminated. This mythical space of the Ancients is scientific: it makes it possible to order the discontinuous, to harmonize, to classify the human world,’ affirmed Toulze (Toulze,1993)¹ in an article devoted to a study of the Roman space, ‘Centre and periphery in Rome’.

Thus, space is a real object of study, complex and instructive for the knowledge of ancient societies. In recent decades, the study of private and domestic space (houses) in ancient cultures has been the subject of an increased interest, particularly because of the fact that, on the basis of a purely technical and archaeological assessment, it has sometimes been possible to delineate a social and cultural framework (Kent,1990), previously limited to architectural achievements with a public, sacred or funeral function.

In this perspective, several studies have been carried out from different temporal and spatial contexts to show that houses aren’t passive, but are actively used by individuals in the creation, maintenance and affirmation of their social and individual identities (Olsen, 2006). Especially since the publication of the founding work of Amos Rapoport in 1969 under the title ‘House form and culture’, which admitted that the form of material culture, although constrained by environmental and functional requirements, serves above all as a means of communicating information and building cultural identity. The recent social theory of the object has carried out an epistemological revolution by reassessing the role of the house beyond the simple passive reflection of cultures to consider it as an active, structuring but also structured place, through systems of production and reproduction of culture (Chétima, 2015).

In the absence of direct or indirect literary production, and unlike studies carried out in Greek cities or in Rome, the conception of private space in the Punic world is only accessible to us through the archaeological remains. We have no reference work on the subject. For Tunisia in particular, a preliminary level of research consisting of the recording of structural elements and archaeological details is still under way (Fantar, 1985; Lancel, 1990). Therefore, our study is an investigation that focuses on the domestic Phoenician-Punic architectural productions in the Carthaginian territories along its natural borders and its political expansion in the central Mediterranean and during the first millennium BC. This survey is also intended as an experimental workshop which, thanks to the implementation of multidisciplinary methods (mainly taxonomic, typology and syntactic tools) already used with good results on other regional corpora, seeks to clarify the Phoenician-Punic domestic corpus under a new angle. Our research is therefore intended to provide a methodological contribution to enrich incomplete and disparate initial information which suffers from a documentary deficit, partiality and lack of objectivity of literary sources. Our investigation remains deeply rooted in the Phoenician-Punic field and is obviously dependent on its progress, as well as its biases. It tries to understand if the Phoenician-Punic houses could maintain, at the level of their spatiality and visibility, a unity that could identify them respectively as an architectural genotype.

2. BACKGROUND, PURPOSE AND CONSIDERED CORPUS:

This study aims to develop an understanding of the Phoenician-Punic domestic production by means of a syntactic genesis approach. It also aims to comprehend internal spatial organization of the Carthaginian domestic architecture and if these houses could maintain, at the level of their spatiality and visibility, a unity that could identify them respectively as architectural genotype (Hanson, 1998). The identification of the architectural genotype (s) that was the basis of its generation is among the objectives of the study.

The entire process is based on archaeological sources or from archaeological excavations. The choice to prioritize this type of source was self-evident. For the Punic world, we should mention the lack of first-hand written sources. In addition, the archaeological sources have the double advantage of being dated to the ‘Hellenistic’ period, which marks the rise of Punic domestic architecture, its apogee and the extent of its...
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development (from the 6th century BC to the date of 146 BC) and geographically spatialized in a central sphere of the Mediterranean. They provide information on various topics: construction techniques, material culture and house forms, which are all angles of approach for studying the habits and living traditions.

During these four centuries of this Phoenician-Punic period and throughout this extensive landscape, the appropriate question is as follows: does it correspond to conformity or rather a diversity of domestic architecture in its forms, uses and techniques?

First and foremost, the archaeological sites considered for this study are composed of human settlements. The criteria on which we based our choice were mainly of three types: the architecture itself, which emanates mainly from the state of conservation of the remains, the situation in the urban space, the installations associated with these constructions, if they exist, allowing a clear interpretation of the use and function of the space in question.

So, the geographical limits of our study are defined as such:

In African territory

Precisely 550 BC: The date, on which Carthage became an autonomous and independent city governed by the Magonids, ruling its own politics and imposing its political supremacy as well as its cultural preponderance over the Phoenician colonies, as well as over areas that had not been reached by the Phoenician colonial expansion. Since then, the Punic metropolis has established settlements around the central and western Mediterranean basin, such as the Punic settlements of Sardinia, Sicily, Libya and the Balearic Islands. It is also from the 5th century that the Carthaginians acquired an African continental territory.

146 BC: the date of its early decline initiated by the Romans as a result of the last Punic War in application of the famous phrase of Caton l’Ancien: ‘Delenda Carthago est’.

By choice of method, the field of study was deliberately limited to a central sphere of the Mediterranean, we wanted to keep our study such a geographical extension relevant for the theme and fixed by the Phoenician-Punic cities of the central Mediterranean. This region extends over the southern borders of the Mediterranean in African territory and over the two Italian islands of Sicily and Sardinia:

— Settlements on a maritime plateau: the Carthage site,
— Peninsular settlements: the Kerkouane site
— Raised sites/on dominant hills: the Monti Sirai site and the Selinunte site

This research is part of the archaeology of space, in the sense that the material domain (in this case the architectural remains) will be studied as a primary indicator of human and social behaviour, after having been analysed.

In Africa, it is mainly the fruitful excavations on Carthage archaeological site [the Byrsa hill, near the coast and the intersection of Decumans maximus with Cardo X, near the so-called ‘Bir Massouda’ area] and excavations in Kerkouane archaeological site, that give a more or less coherent idea of the development plans in the Punic domestic architecture. This is despite the ruinous state of the sites and the approximate records of the first inventors and despite the diachronic evolutionary state of this domestic architecture.

In recent years and as part of the international campaign planned under the auspices of UNESCO, archaeology, with the contribution of several specialists, has made remarkable progress in terms of knowledge of domestic remains, as well as in the organization of the city and

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the urban topography of Punic Carthage. The Punic dwellings uncovered in the Carthage region are mainly in the form of three clearly identified residential districts:

1. The first one is the Punic residential area known as the ‘Hannibal district’ or sector A, uncovered on the top slopes of the Byrsa hill, dating from the last century of the city’s existence, which constitutes a coherent whole, readable on the ground as a plan and in the form of a subdivision similar to a modern ‘low-cost housing’ complex. This district allowed us to generate and identify 10 housing units (specimens).

2. Near the shore in the coastal plain of Carthage, German archaeologists have uncovered a residential area in its development and extension from its foundation to its destruction on 146 B.C. Its exemplary development during the 5th century BC, during the Magonid period, prompted archaeologists to call it the ‘Magon district’. Its chronology is presented in the field in five different phases. This is an area with large housing units and large rooms, in front of which the remains of the Punic-Punic maritime wall can be seen.

3. In the place called Carthage Dermech under the crossing of the Roman decumanus maximus and the cardo X near the area called ‘Bir Massouda’: This is a district of Punic houses dating back to the archaic period where archaeologists have found and located the oldest layers of housing in Carthage. The chronology of this district is presented in the field in 8 different phases. This district with its different phases of evolution makes it possible to generate and highlight the plan of 10 housing units (specimens) whose archaeological documentation and state of conservation allow an easy reading of the plan and internal distributions and can be maintained for the experimental phase.

11 The archaeological site of Kerkouane located at Cap Bon Tunisien is a Punic site which could have been built in the 6th century B.C. and was abandoned around the middle of the 3rd century B.C. (Fantar, 1984; Morel, 1989; Mahjoubi and Fantar, 1966) and has never been reoccupied and rebuilt by later civilizations. It was uncovered by the French excavations led by P. Cintas and then Tunisian led under M. H. Fantar. This settlement constitutes a unique and exceptional testimony of the Phoenician-Punic civilization. On the basis of an updated housing plan pre-established by M.H. Fantar in 1984, we were able to make an inventory of 57 houses (specimens) whose archaeological documentation and state of conservation allow an easy reading of the plan and internal distributions.

12 Monte Sirai is a city-acropolis occupying the plateau of the homonymous hill on the periphery of Carbonia in southwestern Sardinia, a foundation of the Phoenician colony of Sulcis in the second half of the 7th century BC, before becoming a military checkpoint in Carthage. It was abandoned in the 1st century BC and was only found in 1962 by the team of the University ‘La Sapienza’. It was mainly excavated, identified and documented by Italian missions led by P. Bartoloni (1981, 1982, 1983, 1999, 1999, 2000, 2002) then by M. Guirguis (2010a and b, 2009, 2008 a and b, 2005). On the plateau and according to the two archaeologists (Bartoloni and Guirguis), several historical phases can be distinguished. According to the city plan produced as part of the excavation campaigns by the team of ‘La Sapienza’, University in 2008, we were able to make an inventory of 36 houses whose archaeological documentation and state of conservation allow an easy reading of the plan. Similarly to Kerkouane, the particular interest of this city resides in the fact that the Roman conquest brought hardly any changes or modifications to the city’s urban planning, apart from the dismantling of the fortifications.

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Lastly, an exhaustive sample was taken from these several Phoenician-Punic territories: 185 dwellings in total. This chosen corpus proved to be complex and confusing given the state of the remains which are sometimes ruined enough to allow a good reading and to be restored to its initial state. During this study, we were confronted with some disturbing difficulties to varying degrees that are extrinsic but also intrinsic to the habitat as an archaeological object. The first extrinsic difficulty is documentary: due to the very variable quality of the available documentation and especially the graphic quality, which sometimes makes it impossible to extract the complete and accurate statement of a few potential specimens in the sample. The second concerns the nature of the excavations undertaken, which sometimes allows an evolutionary reading (stratigraphic excavation) but rarely extensive. Some elements, intrinsic to the archaeological object, have also been taken into account.

—The fact that it is a ‘disadvantaged’ material: Domestic architecture, less prestigious than monumental architecture, too often appears to be the ‘poor relation’ of archaeological research.

—Evolutionary and Diachronic material: Dwellings are likely to evolve after their construction. Usually when the archaeologist discovers a building, he discovers its last stage of evolution before its destruction or abandonment.

—A ‘truncated and amputated’ material that has been cut off from part of its plan, volume and/or layout. Among the missing elements, the most notable is the elevation, the superstructures and the cover, to which is added the almost complete disappearance of the furniture.

In view of all these difficulties and by taking the necessary scientific precautions to avoid restitution and mending that can alter the objectivity and impartiality of this analysis, the representation we will have is that of the ultimate phase of occupation and not that of creation or its development. Although it is necessary to undertake a diachronic analysis that is which will be capable of rendering the dynamic dimension of architectural constructions, we have chosen not to consider this evolutionary character anymore. We limit ourselves, also in this research, to the body of dwellings, whose plan of zones and functions is already approved by archaeology.

Table 1: Distribution of the sample by Settlement

<table>
<thead>
<tr>
<th>Site location</th>
<th>CODE</th>
<th>Number of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerkouane</td>
<td>K.</td>
<td>57</td>
</tr>
<tr>
<td>Selinunte</td>
<td>Se.</td>
<td>65</td>
</tr>
<tr>
<td>Carthage</td>
<td>Car.</td>
<td>27</td>
</tr>
<tr>
<td>Monte Serai</td>
<td>Car.</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>185</td>
</tr>
</tbody>
</table>

3. DATASETS AND METHODS:

3.1 RESEARCH METHODOLOGY:

Our approach methodology used these distinct and complementary analytical phases:

—The first is a categorization of the dwellings and covets a deeper lecture of this material by means of a taxonomic classification in order to identify an inventory of space labels and to determine the features of this architecture. At this level of analysis, the aim is to highlight the properties of this domestic space before attempting to understand the models of association that link them to the social domain.

—The second is a typo-morphological classification in order to identify the different types of spatial arrangements that appear throughout the sample, to identify their fundamental elements at different organizational levels in order to establish the ‘canonically’ configurations associated with certain ranges of meaning and function.

—The third, which represents the basis of this research, is syntactic and based on an approach that crosses analysis by justified permeability graphs and graphical visibility analysis VGA. For the execution of

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13 Selinunte, the ancient Greek city located on the south coast of Sicily. In 409, it was besieged and destroyed by the Carthaginians, and remained under Punic rule until the middle of the 3rd century BC. After the occupation of the city, Punic residential quarters were established on the Greek acropolis and remained active until the First Punic War when the inhabitants were deported to Lilybée (Tusa, 1971). The Punic facies of Selinunte, which is verified and confirmed in the new urban settlement of the acropolis on which a district of modest dwellings is built, was identified and excavated by an Italian and French team led by Tusa (1971). The excavation was recently completed by another German team under the direction of Sofie Hélas, which allowed a better understanding of Punic period urban planning (Hélas, 2006). The housing districts have enabled us to generate and identify 65 specimens that will be maintained for the experimental phase.

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the first analysis, ‘AGRAPH14’ software is used. For the second type, ‘DEPTHMAP15’ software, which mainly allowed us to refine the results given by ‘AGRAPH’, is used. The main objective of this part is to demonstrate the existence of a cultural model (dominant genotype) of the habitat in this area and at this time or rather the existence of several genotypes that their adjustments imply the existence, at least, of a schema summarizing the main lines of what has been built.

3.2 TAXONOMIC APPROACH:

In the first instance, an inventory of space labels was compiled from 185 different plans, and it contains 10 labels (table) that occurred in at least 75% of the plans:

<table>
<thead>
<tr>
<th>Space label inventory on the Phoenician-Punic house</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table 2:</strong></td>
</tr>
<tr>
<td><strong>Inventory of space labels</strong></td>
</tr>
<tr>
<td>Main Courtyard</td>
</tr>
<tr>
<td>Corridor – Passage</td>
</tr>
<tr>
<td>Pivot</td>
</tr>
<tr>
<td>Room 1</td>
</tr>
<tr>
<td>Room 2</td>
</tr>
<tr>
<td>Room 3</td>
</tr>
<tr>
<td>Room 4</td>
</tr>
<tr>
<td>Room 5</td>
</tr>
<tr>
<td>Room 6</td>
</tr>
<tr>
<td>Living and sitting room</td>
</tr>
<tr>
<td>Sanitary service</td>
</tr>
<tr>
<td>Preparation area/kitchen</td>
</tr>
<tr>
<td>Shop – Store/Workshop</td>
</tr>
<tr>
<td>Stairs to the floor</td>
</tr>
<tr>
<td>Domestic storage</td>
</tr>
<tr>
<td>Domestic chapel</td>
</tr>
<tr>
<td>Shop – Store/Workshop 02</td>
</tr>
<tr>
<td>Secondary Courtyard</td>
</tr>
<tr>
<td>Room 7</td>
</tr>
<tr>
<td>Shop – Store/Workshop 03</td>
</tr>
<tr>
<td>Shop – Store/Workshop 04</td>
</tr>
<tr>
<td>Corridor vestibule 2</td>
</tr>
<tr>
<td>Corridor vestibule 03</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

Then, this approach was based on a multi-varied classification of the sample that takes into account the following criteria, defined according to the context and objective of this analysis:

1) The first and easiest criteria to apply is the surface area occupied by the house16.
2) The nature of the dwelling’s occupation (common and contiguous, isolated houses).
3) The presence or not of a courtyard and the organization of the pieces relating this courtyard (linear, central, radial, chequerboard, hive…)
4) The presence and nature of the transition space (corridor/vestibule) providing access to the house and constituting the interface between public space which is the street and the private introversion space which is the courtyard.
5) The existence of stairs or their traces which confirms the vertical extension of the dwelling (upper rooms – functional floors and accessible terraces)17.
6) The number of rooms recognized and identified by the excavations18.

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14 AGRAPH is a PC-application for drawing Space Syntax graphs and for doing Space Syntax calculations. AGRAPH is made for drawing graphs on the basis of imported background images such as floor plan drawings. (Bendik and all,2005)
15 Depthmap is the main computer software used by spatial syntax theory. It was developed from the intersection of two ideas: the first goes back to Benedikt’s research (1979), which is based on the creation of visual fields at certain points on a building’s plan and on the study of their properties (isovist analysis), the second is the result of the spatial syntax developed by Hilber and Hanson (1984).
16 The area covered by the house is an important indicator of the number of occupants and the social status of the owner: those with more resources have occupied parcels larger than those of less fortunate owners. In this study, we consider only the ground surface, the upper floors haven’t been taken into account because of the hypothetical nature of the reconstructions, which don’t always allow us to understand the total surface area of the habitation.
17 The floors and stairs in Punic houses pose a serious problem due to the complete disappearance of the upper levels. Many questions remain unanswered: could the stairway departures that have been uncovered in some dwellings be considered decisive evidence of the presence of one or more floors? How can we explain the total absence of stairs in some Punic houses that have other clues that lead us to think about the existence of higher levels such as the solidity of the walls and the capacities of the cisterns and reservoirs that can serve more than one dwelling? The presence of the stairs, even the departure with the first steps, suggests in continuity the existence of an accessible and functional space on the first floor. About this space of which we know nothing, we can imagine an upper room, a functional upper floor and perhaps even more than a single floor that traces the same limits as the lower level or a simple terrace. The absence of stair traces is sometimes as problematic as their existence, built and edified in perishable materials that can been deteriorated to disappear over time, such as wood, also poses the problem of assuming floors in this domestic context. For this study and following the example of R. Etienne who, by studying the houses of Volubilis concludes that only the stair steps provide the decisive proof of a floor. (Etienne, 1960) we will consider ‘two-level house’ the house with at least one stairway.

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7) The existence or not of a space of economic activity identified by archaeology as shops, boutiques, workshops or stables.

Results of the Taxonomic approach:

This phase revealed that the majority of Punic houses studied have surfaces ranging from 50 to 149 m² (65%). And that the average surface area of a Punic dwelling is about 122 m² [Fig 9].

In Carthage and mainly in the Magon neighbourhood, the most spacious dwellings sometimes exceed 400 m². They are large residences with plans drawn up in several rooms and dependencies, several commodities and conveniences (ablution, religious and storage areas) and several areas dedicated to economic activity.

Fig 9: Distribution of the corpus according to the average covered surface area on the ground

However, it seems difficult to assign a number of inhabitants/occupants to these houses and to deduce a mode of occupation (nuclear families or groups larger in number) because this data depends on many other parameters (such as information on the number and nature of the floors of these buildings but above all on the nature of this domestic group and its way of life which is difficult if not impossible to determine by observing the plans alone).

Fig 10: Example of Kerkouane Courtyard house

A transition space (a corridor or vestibule) (attested in 148 specimens/185); gave access to this courtyard which, in addition to providing air and light, could also shelter other functions: (01). The sanitary area is recognized both by its installations such as water supply and evacuation systems, wall and floor coverings, but also by the presence of masonry baths or terracotta as the ‘bathtub sabot’ that exist, in fact, in almost all the houses of Kerkouane Punic City. (02). the food preparation area marked by the location of an oven and the edge of a well.

Around this courtyard, rectangular pieces have been arranged in a row, one of which is generally more

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18 Even though furniture indications and artifacts provide valuable information on the use and function of the pieces, We note that in our study context, the furniture is practically non-existent and artifacts that have been removed from their context of deposition as a result of ‘mass’ archaeological excavations undertaken in the nineteenth and early twentieth centuries, using systematic excavation techniques that, due to a lack of means and precipitation, have caused the loss of information indicating their origin and context. However, an important indicator that has helped us to detect the functionalities of the spaces is the floor coverings. Despite that and as the functional labelling of all internal spaces and pieces couldn’t be identified from the literature, this study has identified different reception spaces, sanitary service and food preparation areas, corridors, entrance spaces and courtyards and marked the other spaces with encrypted pieces (P1, P2… Pn).

19 the corridor is sometimes a demonstration of a great concern and search for preserving the privacy of family life with a curved aspect and a tendency to narrow towards the interior of the dwelling

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spacious than all the others. Sometimes it ensured the second house’s access and was probably dedicated to the reception (127 archaeological attestations). It is also remarkable the number of small rooms/antechambers/thalamus not larger than storage rooms and serving, a priori, as a small warehouse (at least 177 houses have a room without direct light and therefore called a dark room).

These houses are mainly supplied by a small economic activity. We note the presence, in most cases, of rooms opening only on the street, sometimes with a second room as an annexe serving as a storage area that can be connected directly to the courtyard. These pieces had to be shops or workshops dedicated to the artisanal activity (these multifunctional spaces are attested in 86 houses, the annexed rooms are certified in 22 specimens). We note that some houses have more than one space for economic activity, up to four in rare cases.

Some houses had spaces dedicated to religious activity, a kind of domestic chapel attested in 04 houses in the corpus. Others were two or multi-levels and only the first steps of the stairs remain (traces of stairs are attested in 55 specimens).

One of the achievements of this taxonomic analysis is the establishment of a functional program for the Phoenician-Punic house [Fig 11].

It allowed us to deduce a recurring functional program for this house and it highlighted a fundamental character for all these domestic buildings, which is, in fact, the existence of a quadrilateral space larger than the other rooms: an open courtyard20 (181 examples/185).

Because of its layout and position relating other pieces, its location relating outside and the way how it is accessed, this courtyard structured the planimetry of the entire Phoenician-Punic domestic space and constitutes the Centre of the movement/circulation system.

Even if secondary relationships can be established by doors between peripheral rooms which most of them aren’t accessible from the street and otherwise they would have had the economic function of stores/workshops.

![Fig 11: The recurrent pattern of the Phoenician-Punic house throughout the sample](image)

**3.3 TYPOLOGICAL ANALYSIS AND IDENTIFICATION OF DOMESTIC PHOENICIAN-PUNIC CANONICAL TYPES:**

In our sample, we commonly find houses where this courtyard is obviously given the central place to be surrounded by all the rooms: it is the courtyard with a central position. This courtyard was undoubtedly the main element of the composition and the common characteristic of these centripetal and introverted houses, closed from the outside, in which it’s also assumed the function of division. As this constant (the courtyard) in the architectural structure is observed, its location, size and shape and how it is accessed are in fact the main criteria for other subdivisions. Hence the typology we propose, which doesn’t consider the evolution of the houses or the problem of functions of its constituent spaces, but which aims to spatial identifying the canonical Phoenician-Punic types and taking only into account simple, morphological and purely related to the court criteria. These characteristics allowed us to identify four types of dwellings that can also be divided into variants [Fig 12].

**Criterion 1:** The presence or not of a courtyard (we classify as ‘out of scope’ the dwellings that didn’t have

20 The portico and peristyle courtyard is undeniable considered by archaeologists of the Punic world (Fantar, 1985) as a direct emprunt from Greek architecture and was only adopted as a Punic domestic architectural layout in the second half of the fourth century BC. At that time and in Kerkouane, only two cases of peristyles were documented. In Carthage, this pattern was, among other causes, at the origin of the major redevelopments observed in the ‘Magon’ neighbourhood at that time (Racob, 1985). The Punic portal courts also reproduce Greek layout techniques, such as the presence of a shelter in the courtyard or the closing of the access to it through a vestibule, and are documented at least from the second half of the 4th century BC in the courtyards of Kerkouane Punic houses and later in the ‘Magon’ neighbourhood in Carthage.

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a courtyard in their layout;

**Criterion 2:** How was the access to this courtyard (direct access from outside OR/AND through a transition space)?

**Criterion 3:** The location and position of this courtyard in the dwelling composition (central or decentralized position relating to the layout);

**Criterion 4:** The shape of this courtyard (square, oblong, indefinite);

These characteristics made it possible to identify four types of dwellings, which can also be divided into variants according to, for example, the nature of the transition space if it exists (corridor/vestibule), acting as an intermediary between the street and the courtyard and creating an entrance sequence that constitutes, so to speak, an introduction to the internal reality of the house.

**Fig 12: Proposed typology and classification into canonical types of Phoenician-Punic houses**

**Type I: House with direct access to the courtyard (without transition space)**

<table>
<thead>
<tr>
<th>Main compositional variants of type I observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variant 1 – With a central courtyard in a stretched oblong shape</td>
</tr>
<tr>
<td>Variant 2 – With a courtyard in a central position, square.</td>
</tr>
<tr>
<td>Variant 3: with a decentralized courtyard</td>
</tr>
</tbody>
</table>

**Type II: House with direct access to the courtyard and another through a transition space**

<table>
<thead>
<tr>
<th>Main compositional variants of type II observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variant 1</td>
</tr>
<tr>
<td>Variant 2</td>
</tr>
</tbody>
</table>

**Type III: House with indirect access to the courtyard through a transition space**

<table>
<thead>
<tr>
<th>Main compositional variants of type III observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variant 1</td>
</tr>
<tr>
<td>Variant 2</td>
</tr>
<tr>
<td>Variant 3</td>
</tr>
<tr>
<td>Variant 4</td>
</tr>
<tr>
<td>Variant 5</td>
</tr>
</tbody>
</table>

**Type IV: Out of scope**

Application of space syntax to the study of the housing in the Phoenician -Punic era in the central sphere of the Mediterranean **ID number 160**
The geometric type III is strongly dominant with more than 72% (160 specimens) [Fig 13] and includes introverted houses organized around a courtyard/a portico yard/a peristyle; framed by rooms on two, three or four sides and whose entrance is mandatory through a long or short transition space.

**Fig 13: Distribution of the corpus by type**

Type II relating to houses that had direct access to the courtyard and a second connection with the outside via a transition space is almost totally restricted to Selinunte site [Fig 14].

The Selinunte site displays the four types. We attach this observation and associate it with the different influences that were being manipulated.

The Carthage site displays only the type III with indirect access to the courtyard through a transitional space.

Can we attach this to a spatial logic, typically Carthaginian that emerges from this dominant distribution model with 72 percent of our sample?

According to Steadman et. al (1991), geometrical distinction, characterizes a distinct ability to accommodate different generic functions, which can often be explained by reference to the range of activities found in them. Each geometric type captured a relatively specific boundary point on the basis of the defined criteria. Thus, the Phoenician-Punic domestic space is managed by a spatial logic relating to several distribution and organization models and geometric variety, one of which is, at least, strongly dominant without being unique. This logic underlines and translates, through its material form and spatial configuration, a social logic which organizes the collective and personal territory of this domestic space and gives an image of the social relations of its inhabitants. According to Hillier and Hanson (1984), if a certain order of space clearly manifests itself in a built environment, then this undoubtedly ordering concerns the order of relationships between the inhabitants of that space.

For this end and to answer these questions, we have adopted a syntactic approach that stipulates that any spatial organization linking the spatial order to the social order can be called genotype and therefore postulates the existence of a cultural model (Hanson, 1998). It also suggests that, although there is no single ‘type’ of Phoenician-Punic house in this exhaustive sample, defined as a ‘more or less’ standard way of how the Punic designed and built his house and how he organized his rooms, there is evidence of an underlying ‘spatial functional genotype’, defined in terms of relational and figurative coherence that occur under different ‘phenotypic’ arrangements.

**3.4 SPACE SYNTAX AND GENOTYPIC CHARACTERIZATION OF THE SAMPLE:**

In this section, the first step is to explore the morphological structure of the spatial arrangements of these specimens in order to decompose them into their convex organization and translate them into justified graphs in a ‘house by house’ approach.

The justified graph is used as the basis for structural and syntactic analysis. It is the permeability structure where every convex space in the system is identified according to its relation to every other space or the relational logic of parts to the whole. Hillier describes the characteristics of a justified graph as: ‘These are the spaces at depth one from the root. Then an equal distance above the depth one row we align the spaces that connect directly to first row spaces, forming the line of depth two spaces, and connect these to the depth one spaces, and so on’ (Hillier, 1996).
The study of each example was completed as follows:

1- The justified graph(s) was/were drawn for each example 21(185 in total). A basic justified graph, where all the convex spaces in the house structure were aligned above the carrier of the system [the exterior] has been drawn for each house. The justified graphs corresponding to the entrance were drawn to illustrate the ‘sequence’ of the permeability of different home users from the entrance to the interior of the house. Some examples are shown in the table below 22[Fig 15].

![Fig 15: The justified graphs of some specimens](image)

### Some Selinunte Houses with their justified graphs
- **Maison 1**
- **Maison 2**
- **Maison 3**
- **Maison K1**
- **Maison K2**
- **Maison K5**

### Some Kerkouane Houses with their justified graphs
- **Maison K1**
- **Maison K2**
- **Maison K3**

### Some Monte Sirai Houses with their justified graphs
- **Maison S1**

### Some Carthage Houses with their justified graphs
- **Maison C1a**
- **Maison C1b**
- **Maison C2**

---

21 To facilitate this task, we manually implemented an operation to code the spaces constituting the house, the objective was to simplify the reading and densification of the data obtained as well as the reconstruction of the object from the recovered clues through its coded encryption (Deloche, 1985).


23 Each specimen is represented by a justified graph. The spaces revealing realities relating to traffic and human activities will be represented in the graphs by colour-coded nodes:
- The red colour indicates traffic and grouping spaces such as courtyards, entrance, interior distribution, corridors and vestibules.
- Indigo blue materializes service spaces such as washrooms, baths and kitchens.
- The green colour materializes mono functional spaces such as rooms.
- The white materializes the stairs that allow access to the first floor.
- The yellow colour materialises the functional operating spaces dedicated to economic activity (commerce, metallurgy, industry, agricultural activity such as oil presses, storehouses, domestic depots...). Those spaces are materialized in the justified graphs but in a second step will only be considered in the calculation if they have a direct relationship with the different spaces constituting the dwelling, when they are internally accessible from the house.

Application of space syntax to the study of the housing in the Phoenician-Punic era in the central sphere of the Mediterranean **ID number 160**
Then, a syntactic analysis of the spatial properties of the main functional spaces of the Phoenician-Punic house, which should lead to a more general proposition about the pattern of spatial configuration and to display possible spatial types within the sample. [Table 5]

Table 5: Syntactic properties of convex spaces: Kerkouane dwellings

<table>
<thead>
<tr>
<th>Spacenames</th>
<th>Nbr CS</th>
<th>HKM terre</th>
<th>Integration (1-5)</th>
<th>Proportion</th>
<th>MD</th>
<th>SLR</th>
<th>BDF MD F</th>
<th>BDF entr F</th>
<th>ORDE F</th>
<th>EXPLOITATION DANS LES MAISON DE CORPS - EXTRÉME OCCIDENT</th>
<th>Valeur maximale</th>
<th>Valeur minimale</th>
<th>Codage orth.</th>
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<td>2</td>
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<td>0.8</td>
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<td>0.14</td>
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<td>0.35</td>
<td>0.1</td>
<td>2-5</td>
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<td>0.13</td>
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<td>0.3</td>
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<td>0.15</td>
<td>0.1</td>
<td>ORR 0.35 a</td>
</tr>
</tbody>
</table>

CS: stands for convex spaces, MD: stands for mean depth, BDF: stands for base difference factor, SLR: stands for space link ratio.

Application of space syntax to the study of the housing in the Phoenician -Punic era in the central sphere of the Mediterranean ** ID number 160
The results of the tables illustrating the structuring modes of all specimens (the cell integration order into the Phoenician-Punic house program) show interesting findings [Table 6]:

<table>
<thead>
<tr>
<th>Specimens</th>
<th>Mode d'intégration T1</th>
<th>Mode d'intégration T2</th>
</tr>
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<tbody>
<tr>
<td>Kerouane</td>
<td>57</td>
<td>03</td>
</tr>
<tr>
<td>Seiliane</td>
<td>59</td>
<td>06</td>
</tr>
<tr>
<td>Carthage</td>
<td>08</td>
<td>18</td>
</tr>
<tr>
<td>Monte-Sirai</td>
<td>32</td>
<td>04</td>
</tr>
<tr>
<td>Total</td>
<td>156</td>
<td>31</td>
</tr>
</tbody>
</table>

---

A first order T1 dominant, strong and vigorous, constituting a spatial structuring mode that proclaims the courtyard as the most integrated and integrating space of the domestic layout. (155 specimens), generating a strong spatial difference between living spaces, integrating the exterior into its strong integration model, having a more integrating interior, and a more integrating exterior.

A Second order T2 less important with the transition space as the most integrated and integrating place in the house. (30 specimens 28 of which are courtyard houses) creating more internal segregation between living spaces and more spatial differences between them (BDF = 0.50), separating the interior more clearly from the exterior, and having a more segregated exterior. Although the transition space is the most integrating space through these specimens, the courtyard also becomes so if the exterior is omitted.

---

For the dominant group 1 (83%): 155 specimens are structured, mainly around the courtyard, being the most integrated and integrating space of the layout (1st rank on the inequality genotype). This is a pivotal cell and a kind of convergence pole that varies according to qualitative syntactic characteristics, i.e., the degree of annularity of the system and the ways in which the different nodes of the justified graph are arranged.

---

The plans with tree graphs constitute 60%, i.e., 93 specimens of this first group despite the scope of the functional program (house functions) which may be elementary or developed or the nature of their configuration which may be pure or with a tendency of low potential annularity. We are faced with a mode of habitat characterized by an internal movement from the exterior, extremely controlled and highly predictable considering the layout of the plan which presents minimal traffic options and type b space sequences which lead to a type ‘a’ space.

Outside the courtyard, which plays the role of the convergence pole of the configuration, and through a transition cell (long corridor in 95% of the cases), the system ensures its distance from the exterior, thus the corridor is the trans-spatial solidarity cell of all these specimens.

---

The plans with annular graphs constitute 40%, i.e., 62 specimens; including 07 with an internal

---

24 Given by the presence of stair traces which pleads in favor of a superior functional space (roof terrace/upper room/functional floor).
Annular configuration that connects those with tree plans in the existence of a transition space that ensures the role of the filter and manages the resident/visitor interface that seems timid and mispronounced and a courtyard that ensures the function of the pivot space of the internal circulation and the convergence pole that articulates the system but especially that announces a more visible and pronounced interface between residents.

—Concerning specimens belonging to group T1 with external and complex annular configuration and representing 30% of the buildings considered (55 specimens in total), we find more permeable dwellings (with at least 2 accesses from the outside) which represent, in their configurations, a confirmed mediation space between the two categories of users of the dwelling (visitors and residents). The pivotal role which also ensures distance from the public sphere and trans-spatial solidarity is materialized in favour of the resident/visitor interface and is extended to connect the main transition space of the house (the corridor/vestibule), the reception room and the space dedicated to economic activity. In those cases, multiply the number of entries, although it has offered, to the systems, the opportunity to differentiate and articulate more easily the comings and goings within this external ring, it hasn’t influenced this desire and concern to confirm the discretion of the private sphere by a strong control exercised by the court through the sequencing of cells that can also be seen beyond this convergence pole. Where it can clearly be observed that the configuration tends to be articulated in sequences and thus to structure and differentiate more clearly the activities and categories of persons associated with them.

To conclude this part, and independently of the properties and implications of the tree structure and annularity of the systems that make up our corpus, there is a particular concern and an intention to establish a clear demarcation and a frontier between the inside and the outside world by the means of:

—A well-defined and highly controlled trans-solidarity interface (a filter interface) that can be limited to a cell (the transition space that ensures the penetration of the system) and can be expanded to include other spaces (the reception room and the spaces for economic self-production). This interpenetration is beyond ensuring greater permeability to the system, perfectly plays the role of the filter distancing the system from the outside world and is preparing to fulfill the theoretical role of the main mediation space between the two categories of housing users: visitors and residents and between two realities, two dimensions: the urban one relating to the street and the domestic but collective dimension of the house. This entrance sequence is never exposed to direct light; it is characterized by this dark atmosphere that contributes to the osmotic relationship between the interior and exterior. It is an introduction to the internal reality of the house and helps to guarantee the intimate nature of the private-collective space (the courtyard: where the relational and collective dimension of housing takes shape). This transition space (corridor/vestibule) is the first level of introversion of the house.

—A courtyard that occupies in all specimens, whether they belong to the first dominant group 1 (83%) or the second one (according to the order of integration), the role of the pivot of internal traffic and the convergence pole of the system articulating and managing. Thus, the relationship between residents (the resident/resident interface). A space that isn’t public but nevertheless collective, shared and considered as a pivotal space that controls access to all cells/rooms, and promotes filtered flows filtered and selective relations between inhabitants and also as a functional space where the main domestic activities and practices take place. We note that the well water, which is always located in the courtyard, is an element which, through the essential practice of water supply, favours meetings between the inhabitants and the sharing of daily needs and domestic activities.

Consequently, in terms of differentiation, the main living rooms, courtyards, reception rooms, different types of service and storage areas, ablation areas (baths and domestic chapels), in the sample of dwellings considered, were regularly characterized by similar syntactic properties. This strong regularity in the planning of these buildings (their programme) and in the formal ordering of their constituent spaces but also in the fundamental syntax of their configuration may suggest a Phoenician-Punic architectural genotype. A genotype that can be generalized throughout the Phoenician-Punic koinè, and which doesn’t correspond to a strict framework but rather to a set of principles that can serve as valuable clues in understanding the built environment of this population.

Application of space syntax to the study of the housing in the Phoenician-Punic era in the central sphere of the Mediterranean **ID number 160
3.5 VISIBILITY GRAPH ANALYSIS AND THE DETECTION OF SYMBOLIC ASPECTS OF PHOENICIAN-PUNIC DWELLING:

The results obtained by the visual integration graphs corroborate and confirm the results of the permeability analysis. We were able to conclude that the structuring spaces shared by all the inhabitants, such as the courtyards and peristyles, are the most visually integrated spaces in the house and that the variation in the visual integration within it is only an indication of the desire to preserve intimacy and privacy.

Then we distinguished that the transition spaces are less integrated than the courts but more so than the living rooms, which are characterized by an obvious visual segregation that reflects great intimacy (perhaps it is a gender-specific space?).

These results prove that the courtyard, which is the emblematic space of the Phoenician-Punic house par excellence, allows interaction between the inhabitants while at the same time ensuring their respective privacy (integration and visual intrusion). Cautiously, we launched that this space dedicated to domestic activities could be a female-dominated domain.

The results obtained by the graphs of visual control and controllability show that the courtyard is the visually dominant space throughout the domestic space and that all other spaces of transition, life and service are visually controlled.

This confirms once again that dominance is another symbolic aspect of the Phoenician-Punic house.

—The results obtained by the visual entropy and clustering coefficient graphs show:

1. For the first measure low values for the most integrated spaces (courtyards and transition spaces) for the majority of specimens and high values for pieces and closed rooms.

2. For the second measure, values tend to be low in social spaces (courtyards, transition and sociability spaces) and high in the private domain of the house (rooms and bedrooms).

The comparison of these two visibility measures show that the courtyard appears to be placed, in all
This provides a coherent scheme and pattern: private spaces are strongly grouped together and social spaces offer multidirectional fields of vision in houses, which is also due to their own geometry, as they are small with partitions to structure the space which tends to be irregular in shape. This contributes to the creation of many junctions and turning points in the spatial structure. This leads to a loss of visual fields and thus brings together most of the spaces beyond the courtyard where the partitions are perfectly organized to structure the interior space without limiting its visual continuity too much.

4. CONCLUSIONS:

However, if we have been able to demonstrate that the Phoenician-Punic dwelling is often structured and centred around the courtyard, which is also the main and omnipresent functional space of the layout and that sometimes it is organized around the transition space. This raises an important question: does this house, organized around a transitional space, mean the same as the one organized around the courtyard? Or does it pose other social circumstances?

The distinction between the organization of the domestic space around the transition space or its structuring around the central functional space has been addressed in other studies. For example, Hillier and Hanson (1984) noted that such a distinction may express differences related to class but also to gender and privacy needs. It is obvious that we don’t know much about the cultural identity of the Punic and his character but it seems certain that the courtyard, by its position and the work functions attributed to it and associated with women (food preparation space – ablution and washing service space by the existence within it of water supply points) that it is a space dominated by women.

A key aspect of this is often the relationship between permeability and visibility. The structure of the permeability of a complex depends essentially on how the relationships of spaces with their immediate neighbours are constructed into a system of possible paths. If permeability defines where we can go and how to get there, visibility tells us, then, how much space we can approach without moving from our place? Visibility relationships are often, it seems a means by which the basic permeability syntax of a complex is adjusted into a more effective device to interface or distance the different types of relationships. To this end, we have subsequently initiated a syntactic study of visibility25, which is considered to be visual accessibility, as opposed to permeability, which is physical accessibility and corresponds to the control of the visual information provided to observers (inhabitants and visitors) at a given location in the house that is directly related to its geometry and also to the observer’s movement.

The results obtained by the permeability analysis show that the exterior zone is always segregated from the domestic life, which confirms the social code in this culture. Concerning the spatial interface between visitors and inhabitants the study provides further understanding of Phoenician-Punic domestic environment in terms of visitors and inhabitants interface. In actual terms, the interface is between visitors and family domains.

The graphs and values obtained by VGA reflect and translate in terms of spatial configuration the fact that the highly connected spaces that are courts, transition and reception spaces are powerful spatial genotypes. These are because they control access, permeability and offer a wide field of view and focus on the different aspects of the layout compared to private spaces (bedrooms and cells of topologic types ‘a’ and ‘b’). While the first group of shared spaces is rather accessible by also offering a multidirectional field of view, the second group of private spaces is too clustered and restricts visibility. This dichotomy seems to be characteristic of Phoenician-Punic domestic spatial arrangements.

At last and beyond the universal aspect of the courtyard house, this is indeed one of the two great models of urban housing known in history and maintained over time. This Punic population has refined it well,

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25 This type of study has often been used as a means of refining the study of permeability and accessibility and as a more effective means of interacting and distancing different types of relationships ['Into a more effective device for interfacing and distancing different kinds of relationship'] (Hanson, 1998). The role of visual fields in a domestic context is closely related to the control of information provided to observers, including residents and visitors.

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sophisticated it, and adapted it to these needs especially in terms of ‘privacy’ by the strength and robustness of a dominant cultural genotype that proclaims this court as the centre of gravity and the pole of convergence of the system and on all points of view, by a functional differentiation and a recurrent sequencing of cells that illustrates the theoretical concept of spatial solidarity between the two interfaces, reinforces the intensity of the social relations related through the spatial order and increases control within this house.

Beyond the absence of distinctive geometric properties, extrinsic and shared by all specimens of Phoenician-Punic dwellings (several phenotypes already mentioned), they present a coherent scheme: (01) Private spaces that are strongly grouped together, closed, deliberately limiting visibility and permeability and controlling access through very strong control. (02) A courtyard, the ultimate shared social space, controlling access and permeability, offering multidirectional fields of vision in the houses and visualizing essentially the entire system through such strong control

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