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# Abstract

The Mayan city has been studied from very diverse perspectives, but rarely have these studies been carried out from an architectural and urban point of view, understanding these terms as the science or the art of «building, ordering, renewing or planning an urban sector or a city». Up to now, there hasn't been a study focused directly at elucidating about the existence of planning in the Maya cities, however this has been a subject that has been indeed on the table throughout history. This is the main purpose of this research, so we can verify through the study of urban areas, the initial hypothesis which assumes that the Mayans planned their cities.

In most of the prior urban studies, urban cartography is not used as a starting point, due to the difficulty in accessing to information and the dispersal and heterogeneity of it. The advances in digital tools and the media in the past two decades have been of great use for data management, and they have provided access to a high amount of information that was previously unavailable. This current situation makes possible the creation of a homogeneous map database which we consider necessary and essential in order to carry out comparative studies between the different Mayan sites. Therefore, from the very beginning, we suggested the creation of this database as one of the first specific objectives of this research.

In first place, we carried out an exhaustive research of data, maps and cartographic information of the archaeological sites inside the field of study and then, we performed its digitalization. During this period, we compiled over one hundred and twenty maps of seventy different archeological sites (Table 1).

Simultaneously, we analysed the different systems of graphic representation of the compiled drawings. Within this section, it's noteworthy the research that analyses the pros and cons of graphic conventionalism and which is accepted in the field of Mesoamerican studies, that consists in a simplified way of representing mounds as truncated pyramids linked together.

This representation system makes easier a quick and structured overall view of the site, but its layout is conditioned by the subjective interpretation of the professional who conducts the survey; a fact that will directly influence its later reading. Besides, the information that provides the plan regarding to the height of the mounds is vague and, if we compare this system with the representation of the terrain with contour lines, this latter

system seems to be more advantageous and a more faithful representation of reality.

The simplified system of representing mounds as truncated pyramids was understandable in historical expeditions, as a result of the lack of time and resources for a more accurate survey. But nowadays, this representation system is just a graphical heritage of the historical cartography. Following this analysis, we propose a conciliatory solution between the two systems. Consequently, as long as we can dispose of both sets of information, they can be overlapped because they are compatible and complementary. Nevertheless when overlapping, it's important not to eliminate the topographic information that includes the contour lines of the mounds represented as truncated pyramids, as is happening at the moment in some cases.

Afterwards, we proposed a methodological vectoring system mapping of the compiled cartography, and we established graphic standardized criteria of the drawings in order to create the database with uniform and comparable vector mapping. Given that this work stage is the most time-wasting, we sought a system in order to speed up part of the process by making a first automatic vectorization of the plan through computer software, like ArcGIS or WinTopo. During this process, it was of great importance to contact researchers, archaeologists, specialists in this field, and directors of various archaeological projects. They provided the site plan in vector file in many cases, which accelerated the technical process and allowed us to proceed directly to the standardization phase.

As a result of these studies, we developed The standardized mapping catalog, in which, the plans of forty Mayan cities of the lowlands and the corresponding map information of each of them are included.

With this new body of cartography, we can start the phase of analysis of the cities. At this point, we propose a methodology, specially based on compositional aspects, in order to study urban areas and main sets of Mayan cities from different perspectives and at different scales. We establish fourteen points or aspects to be studied in each of the selected sites, such as the territorial references, natural and geographical environment, the overall structure of the city, main directions and orientation axes, visual relationships and urban setting. We have carried out this analysis in ten cities of appreciably different features and from different geographical areas,

with the purpose of finding similarities and differences between them. After the individualized study of several cases, we have performed a comparative by contrasting different surveyed points and also adding, in some aspects, other cities of the corpus.

With the research we have carried out, we can prove that this new cartographic database is very useful. Working with these plans has been of great advantage due to their great flexibility, their quick adaptability to the different types of analysis, their ability to be modified and updated, and furthermore, because we can obtain the information from the maps and carry out estimates such as the building density. This way, we can also separate the different elements and analyse them individually. Therefore we present this database as a very profitable analysis and working material, which can be expanded and will be very useful for future research. In addition, vector methodology together with cartographic homogenization, specially regarding to old cartography, has opened up new research prospects that can be applied not only to the Mayan field, but also to other different areas of study with similar cartographic issues.

The methodology of analysis we suggest for the study of the Mayan cities has also been very useful in order to identify the most important features of the layout of the sites we have analysed, as well as to compare them and therefore to detect patterns, management criteria and formal evolutionary concepts that could prove the initial hypothesis that the urban planning existed in the Mayan cities.

We have observed similar general urban structures of the cities, but with significant differences depending on the geographical areas where they are. The configuration of the cities located in the basin of the Usumacinta and La Pasion rivers is more organic due to its adaptation to the territory. On the other hand, although they have different orientations between each other, all these cities have in common that they are perpendicular and parallel to those rivers. In the Petén region, we have divided the sites we study into several groups or sectors which are connected to each other by wide causeways. Something similar happens in the northern Yucatan region, in the Puuc region, although the difference here is that the causeways are narrower, the different sectors are more distant from each other and, moreover, they usually have less volumetric complexity. We have structured all the sites we study according to the general deviation of the axes of the city layout, which tilt between 5 and 20 degrees to the east of due north. It is interesting that in the north the deviation varies between 10 and 20 degrees, in the central area between 5 and 15 degrees, and in the two sites further south, Copan and Quiriguá, their directions are nearly coincident with the cardinal points, more specifically between 3 and 5 degrees to the west.

We have identified repetitive typologies and distributive patterns within a city and in different sites. The compositional resources we have deployed for the configuration of urban spaces are the same ones, but they differ in the way they are used. We have also observed deliberate deviations in the layout of some buildings or of unique architectural ensembles, which seem to respond to direct relationships with other structures, with astronomical orientations or, as we have sometimes observed, in relation with different construction stages.

One of the main features of the Mayan cities, which nobody questions, is the monumentality of its urban scene. Buildings or architectural sets of such great size were unquestionably created to be contemplated as urban scenes and therefore, the configuration of the space from which these constructions were observed had to be deliberately taken into account. This implies that the most important elements and sets of the monumental areas of the Mayan cities were taken into account, at least, at the same time as the urban space to which they are linked was planned. Following the same logic, they have a relationship with other pre-existing elements since the architectural sets usually follow the same general layout orientations of the site or other architectural ensembles. Therefore, each element was designed taking into account its immediate environment. This way, its planning area is bigger, because it was planned considering other elements, which could be pre-existing elements, extensions or new building structures.

Although each city has its own idiosyncrasy, this analysis has identified not only compositional and geometric features, but also typological repetitions which follow an order and that clearly have deliberate orientations in each of them. We consider that this is more than enough to prove that urban planning existed. As it is expected in settlements with such a long evolution, this planning was carried out through different phases and sectors, adapting the city to the social, political and demographic needs of the moment, but without losing the purpose which was always present in the Mayan cities, that is, by creating large urban scenarios that demonstrate the power of the ruling class.

After determining that the ancient Mayans planned their cities, we have new ways to study as a result of the research we have carried out, and we can make progress in acquiring knowledge of the Mayan urban planning.

During the process of analysis of some of the sites, we observed that the structures which follow the same orientation were built during the same period. Carrying out a specific study so that we can verify this hypothesis would be highly interesting, because if we can confirm this, it would represent a crucial piece of information that would permit us to reconstruct the evolu-

tion of a certain city. It could even be used as a basis in order to consider new strategies for archaeological excavations.

One aspect of the composition that hasn't been solved yet despite having been widely studied is the reason why the majority of Mayan cities were laid out along an axis with a deviation of between 5 and 20 degrees to the east of due north. There is archaeoastronomical research currently being undertaken to study the orientation of some buildings and to look for a connection with the stars or exceptional astronomical events. However, there is currently no research to find an answer for the widespread deviation from the north-south axis that can be observed in the layout of cities throughout the Mayan region. After comparative analysis we have observed that that tilt is more pronounced the further north the site is located, and less pronounced in the south. It would be interesting if we could prove that latitude has a major role in this, or if it can be a crucial piece of information in order to de-

termine the reason of the deviation of the axis of the city layout.

Further aspects for consideration are the urban planning analysis of other Mayan cities by applying our suggested methodology, as well as the comparison of the results through typological, functional, chronological and anthropological studies. This would give us a wider sample for comparative analysis, and a more complete and multidisciplinary vision of Mayan cities.

Finally, once we have proved the usefulness of the new database with homogeneous vector cartography, it would be interesting to continue with the vectorization process, the updating and the standardization of the plans of other sites in order to obtain a wider and more up-to-date database. It would also be very useful to find a system or collaborative software online which could transform the database into vector cartography data within a virtual space where specialized researchers could share and update their knowledge in the subject.