

LINKING PLACE NAMES AND RELIEF IN CIUTAT VELLA OF VALENCIA (SPAIN): AN ANALYSIS USING QUANTITATIVE AND QUALITATIVE METHODS

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I. INTRODUCTION

The irregularity of the terrain and other natural factors (such as the soil quality, the presence of water, the climate, and the exposure to sunlight or to the winds) significantly determine the original location of any inhabited place. It will also depend, nonetheless, on the historical context. Thus, in peacetime settlers usually look for a location on a plain –close to the sea, to a natural port, to a lake, or to a river, or at a junction of roads and/or rivers– in order to facilitate the progress of trade. In times of political instability, however, settlers look for hardly accessible locations, which are easier to defend: a hilltop, a river island, a lake island or an island close to the mainland. The Roman foundation of València occurred in a context of peace: thus the city was located on a floodplain. The exact location chosen was on a river terrace, safe from the violent flash floods of the river Túria, but very close to this river, so that the new city could benefit from a river port located near the seashore.

In this paper, the terrain irregularities of the late-medieval walled town of València (the area known today as *Ciutat Vella*) are detected and studied by means of a double analysis. First, we use a qualitative analysis, based on the study of historical Valencian place names referring to uneven terrain. Secondly, we apply a quantitative analysis based on data obtained from LIDAR technology. Once the topography of Valencia has been analyzed, the influence of the relief in urban settings is studied.

Cities were independently developed by diverse people in many different areas of the world. However, the resulting urban settings show resemblances in their eventual urban configuration: symbolic architecture is located in prominent areas, and around these, neighborhoods characterized by professional specialization are developed. In this paper we study the remarkable influence of topography in this kind of urban segregation in València. This case can be extrapolated to most cities founded on a floodplain.

II. AIMS

The first aim of this paper is to analyze the relief of València's Ciutat Vella, by means of two methods: an inductive approach (analyzing place names that –explicitly or implicitly– reveal elevations and depressions) and a deductive one (a high-resolution Digital Elevation Model (DEM) –created through LIDAR technology– allowing us to observe whether those place names actually correspond to topographic irregularities). The second goal of this paper is to analyze the influence of topography on the social and spatial configuration of cities. For this purpose we intend to answer the question *how does topography influence the segregation of people and of land uses within a city?*.

III. STATE OF THE ART: TOPONYMY AND LIDAR

Toponymy (place names) studies are supported by three main auxiliary sciences converging in a complementary way: linguistics, geography and history. Aided by these three sciences, the classic method of place names analysis studies their origin and semantics. But beyond these, any place name conceals a social and ideological process which can also be studied with the support of other auxiliary sciences, such as sociology and psychology.

LIDAR (an acronym for *L*ight *D*etection *A*nd *R*anging or *L*aser *I*maging *D*etection *A*nd *R*anging) is the most advanced remote-sensing technique for collecting data referring to both the position and the elevation of land elements. This laser-based technology is nowadays crucial for generating high-resolution DEM, since it facilitates mapping ground elevation at a resolution up to 30 centimeters per pixel.

IV. METHODS

The mutually complementary nature of quantitative and qualitative methods, whether they are used simultaneously or sequentially, provides a more complete set of evidences, which facilitates a broader understanding of any phenomenon. This kind of multi-method research aims to combine the best of both approaches: the qualitative one, characterized by ideas in context and requiring detailed, long-lasting study; and the quantitative one, which is more efficient but less predictive. This article uses both methods simultaneously, in order to gain a deeper understanding of the phenomena studied here.

Through the inductive method –moving from the particular to the general– we have explored, found and analyzed current and historical place names related to the topography of València's Ciutat Vella. Sometimes place names of this kind are not easy to detect (as they, not being official street names today, have fallen into disuse) or are not transparent (being unintelligible to modern speakers). Old bibliographic sources are thus often needed to detect and unravel their topographic meaning. On the other hand, we have created a high-resolution LIDAR DEM which has allowed us not only to check and confirm the irregular topography denoted by place names, but also to search and find, through a visual inspection, uneven terrain areas, in order to identify other significant place names that we might have overlooked before.

V. RESULTS

V.1. Description of València's Ciutat Vella

València's Ciutat Vella (Old Town) is the sum of three historical areas, those corresponding to the Roman, the Arab (11th century) and the Christian (14th century) cities. Roman València (called VALENTIA in Latin) was founded by Roman settlers in 138 BC on the right bank of the Túria River, upon an alluvial terrace which was located on a slightly higher level than its immediate surroundings. The location of VALENTIA recalls those of other Western Mediterranean cities such as Montpellier, Arles, Ravenna or Rome itself, which were founded on the banks of a river, close to the seashore and, therefore, with easy access to the sea, but free from the drawbacks of coastal marshes.

From a LIDAR high-resolution DEM of València's Ciutat Vella, we can observe that the area occupied by the Roman settlers is located at an altitude of 15-17 m above sea level, while its immediate surroundings (except for the west area) are located at 10-15 m. All along the history of València, this small hill has been the preferred area for placing the most notable buildings in the city, as it was a natural protection against the secular flooding of the Túria River. Between 1321 and 1957, 22 Túria floods are recorded, plus 11 remarkable rises of the river and 15 instances of flooding which were recorded with no reference to the severity of the event. Moreover, in the subsoil of Ciutat Vella there are flood traces from Roman and Moorish times as well.

VALENTIA was located on the highest area of a small river island. North of this island ran the main channel of the Túria River, while to the west, south and east a secondary functional channel used to flow in Roman times. The area of Ciutat Vella most affected by flash floods all along history is the one closest to this secondary channel or *paleochannel*. Because of the severe damage caused by the big flash flood of 1957, the last stretch of the Túria River was diverted to an artificial canal located several kilometers south of the city, opened in 1972. After this, the former Túria riverbed became a huge public garden 8 kilometers long and 150 meters wide. Nowadays, this diversion of the stretch of river which used to pass through the city of València and the construction of reservoirs along the Túria basin have made a new flash flood unlikely.

V.2. Explicit and implicit place names in València's Ciutat Vella

The first thing that draws attention within València's Ciutat Vella are its smooth *davallades* ('downhill slopes') leading downwards from the Roman and Islamic city into the above mentioned paleochannel of the Túria River. Moreover, within the Roman city there is only one *pujada* ('uphill slope'), so called because, taking the Cathedral as a reference, it leads upwards.

Another explicit orographic place name is *el Tossal* ('the hill'), which is a high area (just 2-3 m above its surroundings) in the path of the Túria paleochannel. This smooth hill – probably artificial – acts as a kind of dam interrupting the Túria paleochannel and preventing floods to flow into *Plaça del Mercat* ('market square'). Its protective effect was limited,

as during the worst floods water flowed beyond it and reached the Market area; on the other hand, el Tossal worsened the flood effects upstream in Roters quarter, which made it undesirable for human settlement. That is why in medieval times Roters used to house unhealthy activities and workshops, such as tanneries.

Outside the Roman city we can find *Cavallers* ('knights') street, located at the highest part of Ciutat Vella. This place name is implicitly related to uneven terrain: being one of the highest areas in the city, it remained safe from floods, and thus it was chosen by aristocrats who from the thirteenth century settled in València to build their city residences there. Another two implicit place names are *Moreria* ('Moorish quarter') and *Call* ('Jewish quarter'), as ghettos harboring non-Christian minorities were located in flood-prone areas near the Túria paleochannel: Moreria was built by its western section (Roters quarter) and Call by its eastern section (Xerea quarter).

After Tossal, the Túria paleochannel widens and becomes Plaça del Mercat, also called Pla de la Boatella ('Boatella plain', from the Latin BOVATELLA, 'meadow for livestock'). This used to be a flood-prone zone. In Rome we find a couple of place names with a similar semantics: FORUM BOVARIUM, a swampy area where cattle grazed; and *Campo Vaccino* ('field for cows'), which was located where the Imperial Forum used to stand. Also in Madrid we find *Paseo del Prado* ('meadow promenade'), corresponding to a low, damp area where a stream flowed and irrigated a meadow for cattle to graze. The Parisian place name of Le Marais ('the marsh'), north of Île de la Cité, also denotes a low, damp, flood-prone area. València's main market was located in flood-prone Pla de la Boatella, which also hosted festivals, tournaments and bullfights, and even executions. Some of the most notable buildings in the city (the Llonja or Silk Exchange, Mercat Central, Sant Joan's Church) were built around Plaça del Mercat, but they were raised on platforms above ground level to avoid their being affected by flooding. Mercat Central is located near Plaça Redona ('round square'), which had been historically known as El Clot ('the pit'), being slightly more depressed than its surrounding area. This used to be one of the most putrid places in the city, since both the fish market and the slaughterhouse were located there. People working at El Clot took advantage of its concave relief to accumulate waste blood and animals' guts in the middle.

VI. DISCUSSION

In this paper we examine –through an innovative multimethod approach– the irregular urban topography of València's Ciutat Vella, which makes certain areas safe from flooding while others are not. València's topography had previously been studied –by Pilar Carmona, among other authors– from a geomorphological and hydrological view. Also the impact of recurrent, violent floods caused by the Túria River overflowing its banks had been described. This paper, however, is not merely concerned with the causes of floods and their consequences on the city and its citizens, but also –and this seems to us to be a new approach– with the study of the historic influence of uneven terrain on València's Ciutat Vella urban configuration.

For many centuries, València's urban configuration was determined by topographic irregularities: the upper areas were occupied by buildings belonging to the nobility and the high clergy, while the lower areas were left to the popular classes (merchants, craftsmen,

handymen) and ethno-religious minorities (Jews and Muslims, before they were expelled in 1492 and 1609, respectively). Topographic place names are particularly abundant around the Túria paleochannel, which used to be an especially flood-prone area.

This kind of urban segregation depending on topography can also be found –in ways that are more or less similar to València’s case– in other old towns of Iberian cities with a flat topography. The case of Barcelona is particularly similar to València’s. The Cathedral, the Bishop’s Palace, the Government palace, the Town Hall and the best aristocratic palaces occupied the upper areas both in València and in Barcelona. By contrast, trade, artisan, and recreational activities were assigned to their lower areas.

Even though Barcelona’s case is particularly similar to València’s, this scheme is repeated in other flat-topography cities such as Seville and Zaragoza. New multimethod research about uneven topography in other flat cities might show us similar results about social and spatial segregation there. Both the study of urban place names and the use of advanced techniques of remote sensing (LIDAR), separately and complementarily, facilitate obtaining very significant results in this regard.

VII. FINAL CONSIDERATIONS

Laser systems remote sensing (LIDAR) can be applied to many fields of science, including geomorphology, hydrology, seismology, meteorology, archaeology, forest and environment management, forestry and environmental studies; they can be used for military purposes as well. The study of place names is usually based upon several fields of knowledge, such as geography, history, linguistics, sociology and psychology. In a new approach, in this article we have used remote sensing (LIDAR) as auxiliary to the study of place names.

Using two different and complementary methods of research –one which is based on place names and the other, on remote sensing– has allowed us to study València’s urban topography in greater depth, and given us greater certainty about the knowledge that we were generating. The first method, which is qualitative, consisted in studying those place names which might indicate topographic traits. It stimulated our curiosity and led us to ask ourselves a number of questions which expanded our research. A second method, which is quantitative, consisted in obtaining numerical evidence for the place name semantics that had previously aroused our interest. Such numerical evidence was obtained through a high-resolution digital elevation model (DEM), which was calculated by means of remote sensing using LIDAR technology. Apart from confirming the irregular topography described by the previously studied place names, this DEM, after a thorough visual inspection, provided us with new evidence of uneven terrain, which could help us find new significant place names. Therefore, simultaneously using two research methods which might have seemed antagonistic –each of them being linked to one of two confronted traditions of geography, historicism and positivism– has proved to be a useful approach to achieve a deeper understanding of the phenomena under study and to gain confidence in creating knowledge.

In this article, therefore, we have used two research methods (the study of place names and remote sensing) to analyze social and spatial segregation in cities having an apparently flat topography. The most important conclusion that we have reached is that, no matter how insignificant urban topography may seem, it is quite a crucial factor in shaping a city’s

configuration. The most prominent areas are home to the social and political elites (the upper clergy and the nobility), while areas characterized by concave relief house commercial, artisan and recreational activities, and are therefore occupied by those social classes which were less favored by the Old Regime (such as traders, artisans, ethnic minorities, etc.). This pattern only begins to change after the bourgeois and industrial revolution of modern times, when the bourgeois classes progressively abandon the old quarters and occupy new, more spacious urban areas.

Being flood-prone, the *lower quarters* ('barrios bajos' in Spanish, which also means *slums* in English) experienced impoverishment, deterioration and abandonment throughout the 20th century. However, hydraulic engineering works carried out over the past decades, which protect these quarters from new catastrophic floods, have turned these neighbourhoods into desirable places to live in, or to visit. Some of them are nowadays experiencing an incipient (or advanced) process of gentrification, since they are located in the city centre, and/or touristification, due to their particular architecture and historic urban fabric.