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Valorization and dissemination of lost urban heritage. Valencia, the walled city

This article shows a case study in which some new virtual musealization techniques such as immersive panoramic photography, rephotography and video animations have been used in order to valorize and disseminate many of the lost urban spaces of the city of Valencia in Spain, mainly those belonging to the ancient walled city. The whole Christian wall was demolished in 1865 along with the majority of the gateways by the governor Cirilo Amorós, with the exception of two of the main gates that were saved from demolition thanks to the fact that them were used as the jails of the city in that period. The research start with a compilation of the ancient representations of the city that has been carried out in order to analyze the urban evolution of the city. The main aim of the study is to develop an interactive visualization of the lost walled city combining a breathtaking ancient bird-eye view by the French architect and lithographer Alfred Guesdon, with an aerial spherical panorama of the current city, which will allow the user to compare how the city has evolved in the last centuries. In order to do so, a thorough study of perspective in the ancient drawing has been carried out to accurately restore the viewpoint. Those views have also been used to create an elaborated video animation that will allow the viewer to get immersed inside the ancient city as in a sort of journey into the past in order to recover the memory of the lost walled city. The interactive results can be visualized though the Internet and some links and QR codes will be given at the end of the article in order to allow everyone, by means of a computer or even a mobile device, such as a smartphone, to visualize all the generated contents.

Key words:
Virtual musealization; Rephotography; Spherical Panorama; Perspective

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INTRODUCTION

The Spanish City of Valencia was founded by the Romans in 138 BC under the governance of Consul Decimus Junius Brutus in the ancient region of Édeta, near the mouth of the Turia River and connected to the *Via Augusta*. The consul gave the colony to the troops who had fought bravely in the Lusitanian campaigns, and that was the origin of its initial name: *Valentia Edetanorum* (valour or courage in the region of Édeta). The Roman Valencia had its heyday in the second century AD when were built some important buildings like temples and one of the largest circus in Spain that could accommodate up to 10,000 spectators. From the third century, the city was declining, like the rest of the Roman Empire, and it was occupied by the Visigoths between 5th and 8th centuries.

After the Muslim conquest in 711 AD, the Islamic culture was established and an efficient network of irrigation was built. The city had a splendor period during the Taifa of Balansiya, between 1110 and 1238. It was a significant urban growth and the first defensive walls were built.

Valencia was conquered in 1238 by the King Jaume I of Aragon and the Christian city began to settle around the cathedral, on the old mosque, and its construction would last until the 15th century. Another important element from this period was the Christian walls, which were built between 1357 and 1370 by order of the King of Aragon Pedro IV to protect the new neighbourhoods which had been created around the former Muslim wall.

The fifteenth century was the Valencian century of gold and the city experienced a demographic peak and it became the most populous city in the Crown of Aragon. In this period the most iconic buildings in the city: Serranos Tower and The Lonja were built. Also the bell tower of the cathedral, named the Miguelete, was completed.

This magnificence also produced a cultural development in all fields and stimulated the emergence of the first representations of the city, which have allowed us to know more precisely the urban development of the city (Sanchis, 1972).

FIRST VIEWS

The first view of the city was published inside *La crónica General de toda España y especialmente del Reyno de Valencia*, written by Pedro Antonio Beuter (Fig.1). The first edition was written in Valencian in 1538. This view is a schematic and idealized view styled like those published in the universal chronicles, in which the city is shown from its northern face, embraced by the Turia River and primarily showing the Serranos Tower, one of the most important gates of the Christian Wall. The Miguelete and the dome of the cathedral are also highlighted.

Another analogous view of Valencia appears in one of the surrounding drawings in the map entitled *El Reyno de Valencia*, by the Jesuit Francisco Antonio Cassaus (1693) (Fig.2). The picture shows the southern side of the city in a schematic and idyllic way where real and imaginary elements are intertwined. The most representative buildings of the city are emphasized again. The Royal Palace, which was destroyed during the war of independence, appears behind the city on the right side.

One of the most representative drawings of the city is certainly the view made by the Flemish artist Anton van den Wyngaerde, who carried out many views of the cities and the major towns in Spain, commissioned by the King Felipe II. The whole work contains views of 62 cities and towns and includes many preparatory drawings, which were made between 1562 and 1570. Wyngaerde drawings were done to configure an atlas which finally didn't see the light (Kagan, 1986).

The view of Valencia was drawn in 1563 and it shows, with big detail, the northern side of the city with the river, bridges and the neighbourhoods that were appearing outside the walls due to a lack of space inside the walled city (Fig.3).

Undoubtedly, Wyngaerde's view shows a qualitative improvement in detail and realism compared to the former ones. However, despite his documentary vocation, the author takes certain licenses in order to idealize the urban space, so the city contour seems to be an almost perfect circle and the most relevant buildings have a bigger scale to gain relevance.

Fig. 1 - View of Valencia in the chronicle written by Pedro Antonio Beuter (1538). *Biblioteca Valenciana*


Fig. 2 - View of Valencia in the map *El Reyno de Valencia* by Cassaus (1693). Source: gallica.bnf.fr / BnF

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Fig. 3 - Anton van den Wyngaerde, 1563, View of Valencia. Source: (Kagan, 1986)

Fig. 4 - Antonio Mancelli, 1608, *Nobilis ac Regia Civitas Valentie in Hispania*. Museo Histórico de Valencia

Fig. 5 - J. Fortea, ca.1738. Reduced scale copy of the map by Tomás Vicente Tosca (1704). Museo Histórico de Valencia
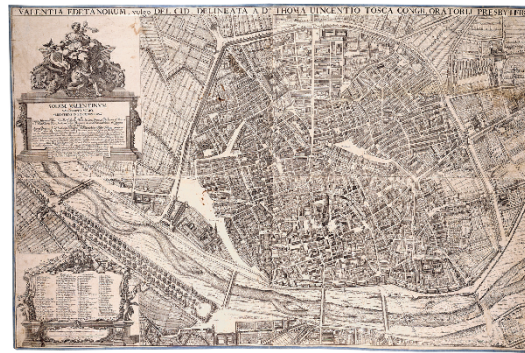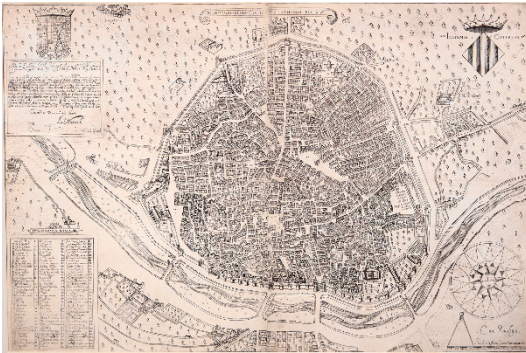
The oldest known map of Valencia was made by Italian Antonio Mancelli in 1608. It was entitled *Nobilis ac Regia Civitas Valentie in Hispania*, and it is a clear prototype of military projection that was made to maintain the metric properties of cartographic representations, while also providing the volumetric shape of buildings (Fig.4).

This representation is more readable than a cartographic map and provides a whole view of the city. It may be well appreciated the layout of the Christian wall and its 12 gates, which were divided into four large portals, approximately coincident with the North-South and East-West axes, and eight other smaller doors that were distributed throughout the perimeter. The natural limit imposed by the Turia River led to a non -perfectly concentric growth, expanding southward. Thus, the primitive Roman and Muslim urban centres, which were at the current location of the Cathedral, remains somewhat decentralized and the new hubs as the Lonja and the market are almost centered in relation to the walled enclosure.

Another renowned representation of the city is the map made by the cleric and scholar Thomas Vicente Tosca, in 1704. It was entitled *Valentia Edetanorum, vulgo del Cid* and it is similar to Mancelli's, but more precise and detailed.

As the author lived in Valencia, he could spend more time and dedication to represent thoroughly all the architectural elements. Father Tosca map is coloured, but, even restored, it has lost many contrast, so it is best known a reduced scale copy which was carried out by his disciple José Fortea around 1738 (Fig .5).

VALENCIA À VOL D'OISEAU.
THE VIRTUOSITY OF GUESDON

In the late eighteenth and early nineteenth century, appeared many publications narrating the experiences of the romantic writers around Spain, which became one of the most attractive destinations due to the mystical halo and the anachronistic image created by these publications.

As a result, many guidebooks were emerging as well as some lithographic or engraved drawings from the main Spanish cities, such as the bird's-eye views made by the French architect, draftsman and lithographer Alfred Guesdon, who was specialized in this kind of representations, reaching a really commendable perfection.

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Fig. 6 - Alfred Guesdon, 1853. *Vue prise au-dessus du Pont San Jose*. Source: José Huguet Archive

The training of Alfred Guesdon as an architect allowed him to learn in depth the foundations and the constructive methodology of the perspective representation and this is evidenced in any of his works, in which geometric perfection and representative rigor is praiseworthy.

The methodology employed by Guesdon began by obtaining cartographic documentation of the city that he later drew in perspective, which provided him with the fundamental basis of the layout. After this process, the volume of the buildings was completed with the help of the partial sketches that the artist got from the volumes and the building typologies. We can see in his works that the artist was very interested in detailing the most representative buildings and he simplified those buildings that remained inside the general urban structure, which is consistent with the statements of

Charles Marionneau, writer of the obituary of Guesdon, published in the *Revue de Bretagne* of January 1876, who described the method used by the artist in the following terms:

"[…] Here is the method he used: with the help of a geometrical plane of rigorous accuracy, which he drew in perspective elevating greatly the horizon line, the artist could trace, on this board so well prepared, the elevation of houses and monuments of the city, just as if you were in a balloon, on a very high point" [1]

Guesdon drew the main cities of France, Italy, Spain and Switzerland [2]. The views of Spain were published in the collection *L'Espagne à vol d'oiseau*, edited by François De la Rue around 1855. This collection included two exceptional lithographs of Valencia,

which were drawn in 1853. The first of them shows the city from the bridge of San José (Fig.6) and the second one from the *Puerta del Mar* (Fig.7). Guesdon views had a certain intention to extol the innovative aspects of the city. The views show a dynamic city with a large industrial activity and modern means of transport like steam boats and trains. These fascinating pictures describe very well the image of the city, just before the demolition of the walls by the initiative of the Civil Governor Cirilo Amoros, who argued this will give jobs to the people that were unemployed because of the crisis in the silk industry, but this decision was taken primarily to allow the growth of the city outwards, as this idea was brewing since 1858 with the first plans to expand the city.

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Fig. 7 - Alfred Guesdon, 1853. Vue prise au-dessus de la Porte de Mer. Source: José Huguet Archive

THE CURRENT CITY AND NEW REPRESENTATION METHODS

Valencia is nowadays the third largest city in Spain, with a population of about 800,000 people. The city has grown considerably due to the execution of many expansion plans that have been carried out around the original urban core.

The city center preserves its main monuments, with the exception of the walls and the majority of the gateways. Only the Serranos and Quart gateways were saved from demolition thanks to their function as jails of the city at that period. The imprint of the walls is still notorious as a rounded perimeter configured by the main avenues of the city center.

The historic core has suffered important modifications to open new public spaces and streets. One of the most important interventions was the demolition of the old convent of San Francisco, in 1891, to give place to the current *Plaza del Ayuntamiento*.

Another of the most relevant urban interventions was the deflection of the Turia river, planned after the great flood of 1957, that has led to a large garden area that runs along the old riverbed and includes some of the most important public cultural buildings in the city, such as the Music Palace, the City of Arts and Sciences and the Oceanographic Park, which are one of the main tourist attractions of the city.

Currently, there are available many new different techniques to represent the city accurately and to document its evolution, such as aerial photography, satellite imagery and LIDAR technology. The arrival of Geographic Information Systems GIS has allowed the access to different layers of information through internet. However, these technical tools are not adapted yet to a non-specialized public, so it may result very useful for divulgation purposes to explore other tools such as Google Earth, which is a very accessible and didactic application that has a very simple and friendly environment designed to any kind of users.

The versatility offered by Google Earth to visualize cities in three dimensions from any point of view has led us to use this tool to make a comparison between the current image of the city and the previous image of the walled city in the middle of XIX century, as it is shown in one of Alfred Guedon's lithographs of Valencia, by using the rephotography technique.

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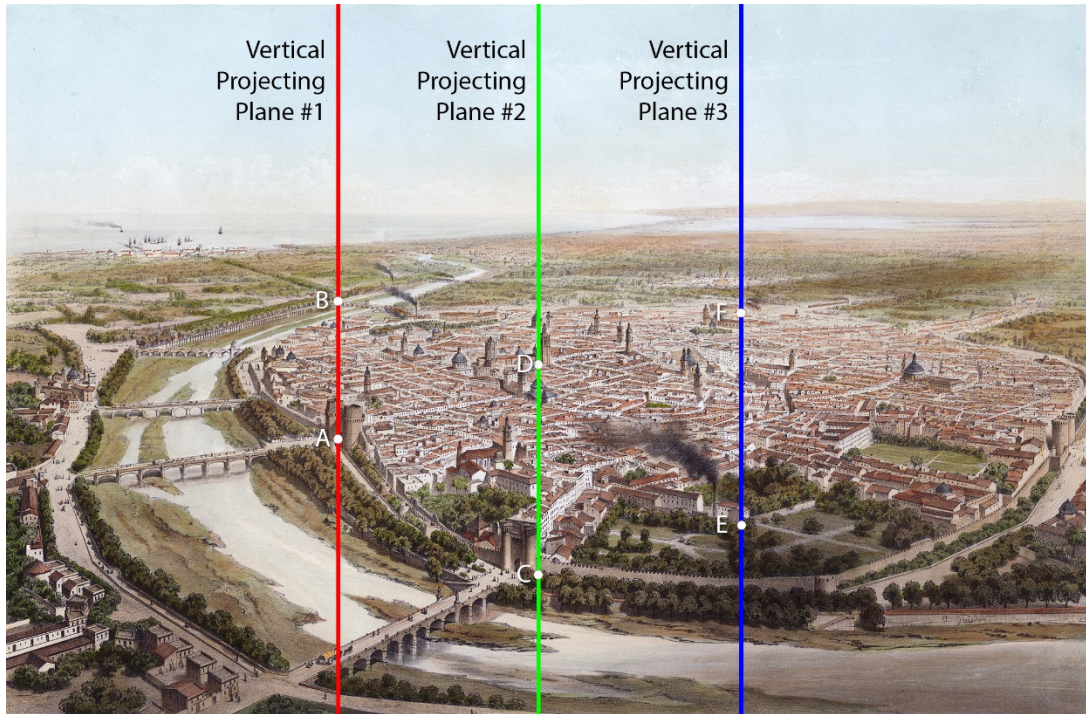
Fig. 8 - Set of vertical projecting planes, which have been considered in order to restore the viewpoint

REPHOTOGRAPHY AS A TOOL FOR URBAN DIACHRONIC ANALYSIS

The rephotography technique consists in taking a photograph from the same viewpoint of another picture, taken in the past, in order to accurately compare the evolution of the photographed scene.

In our case study, we wanted to faithfully restore the viewpoint of one of Guesdon's lithographs, specifically the view over the San José Bridge (Fig.7), which is not a photograph but a perspective made with great skill. In order to achieve a good result using the technique of rephotography, both the viewpoint and the direction of the optical axis of the new photography must be perfectly matched with the older one. Most photographers, who use this technique, try to match the viewpoint and direction with the naked eye and

some of them do it pretty well, as in the case of photographer Mark Klett, one of the pioneers of rephotography [3].

However, we have followed a rigorous and scientific procedure carrying on a thorough study of the perspective in the original picture in order to accurately restore the viewpoint.

THE PERSPECTIVE ANALYSIS

We have worked on an original lithograph of Guesdon belonging to the archive of the Valencian historian Mr. José Huguet Chanza, who kindly lent it for its study. The sheet was digitized at a resolution of 1200 ppp, in order to see many details and to enlarge its original size several times without losing quality, since lithography is a continuous tone printing technique

that, unlike the current offset printing techniques, does not present halftone dots.

The viewpoint restitution of this perspective was carried out by means of an own graphical method in which we study the alignment of singular architectural elements located on vertical projecting planes in the perspective, which are those vertical planes orientated in relation to the viewpoint in such a way that we can see only its profile, that is, we see them as vertical lines. The intersection between two or more vertical projecting planes would be a vertical line that would pass through the observer's point of view, so we have searched for several projecting planes containing notable points that we could place on a plan. In figure 8, a series of vertical projecting planes has been represented over the lithography.

Each of these planes contains two easily recognizable

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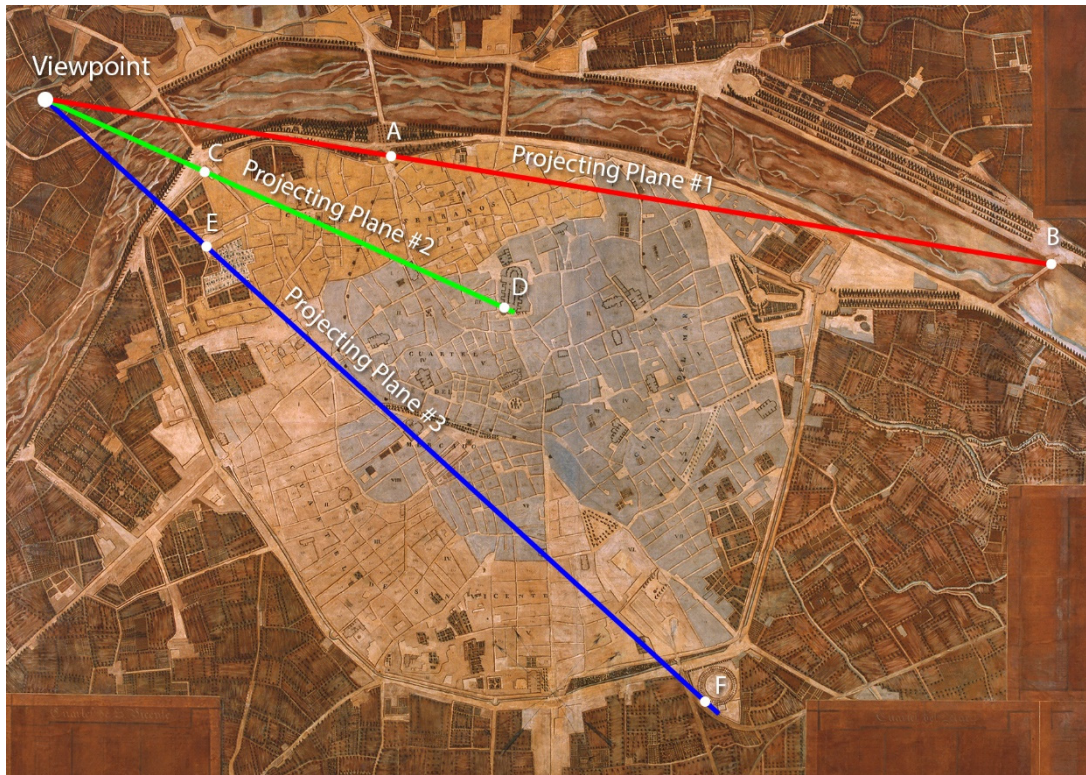
Fig. 9 - Viewpoint restitution from the geometric analysis of the considered projecting planes

points, named with letters, which will make it possible to later draw the traces of the projecting planes on a city plan. The first vertical projecting plane contains a vertical edge of the Serranos gateway and crosses the starting point of the Puente del Mar on the left riverside (red line).

The second vertical projecting plane contains a vertical edge of the missing *Portal de San José* or *Portal Nou,* and passes through a vertical edge of the Miguelete tower (green line). The third projecting plane passes tangent to the right side of the *Plaza de Toros* and contains a vertical edges of a building next to the smoky chimney in the foreground (blue line). A contemporary topographic map of Valencia, drawn in

1853 by Colonel Montero de Espinosa, has been used in order to place the viewpoint, since this plan contains all the former references.

Figure 9 shows the reference points defining the traces of the projecting planes that converge towards the viewpoint, which is now located on the plan view. The represented projecting planes converge quite accurately towards the viewpoint, but it must be mentioned that certain deviations have been obtained in the restitution of the viewpoint when using another set of projecting planes. This shows that Guesdon design has little imperfections that are only perceptible through the meticulous analysis of the perspective, which does not detract from the artist's

skills, but rather confirms his artisanal methodology. In order to estimate the viewpoint height, a new geometric analysis has been carried out by taking into account the proportionality preserved in perspective when the projected element is parallel to the projection plane. In Guesdon's perspectives the projection plane is always vertical, so projected vertical edges of buildings retain their proportionality with their spatial homologous segments since they are parallel to the projection plane. Considering the fact that the horizon line is the intersection between a horizontal plane passing through the viewpoint and the projection plane, the viewpoint height can be calculated by knowing the length of a vertical line

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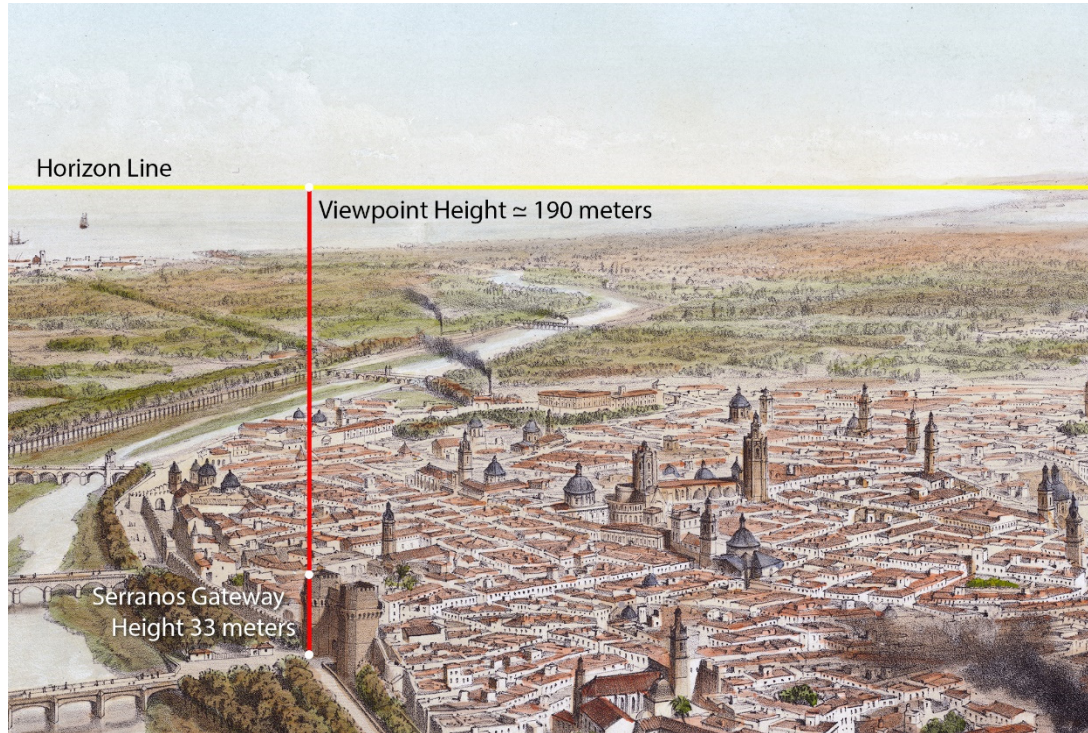
Fig. 10 - Geometric estimation of the viewpoint height by means of proportionality

starting from a point on the ground and ending on the horizon line.

For this purpose, a vertical line starting from the base of Serranos gateway and reaching the horizon line has been taken as a reference. Since this gateway is 33 meters high and the proportionality is preserved in this case, we can establish, by comparison, that the height of the viewpoint is approximately 190 meters, as it is shown in figure 10.

Once the location of the viewpoint was deduced, the ideal step would have been taking the current photograph of the city using a drone, but it is against the law to fly it over urban areas. For this reason, the geographic coordinates of the restored viewpoint have been introduced in Google Earth, using a kml file, and a set of partial shots have been obtained looking in several directions around the viewpoint to cover the whole scene with an overlapping area of about 30% between contiguous images, in order to compose a full spherical panorama. Finally, these shots have been joined with the open source stitching software Hugin into an equirrectangular image (Fig.11).

VIRTUAL VISUALIZATIONS AND VIDEOS

To make the comparison between the current state and the picture of the walled city, an interactive web based visualization has been designed to be available through the internet. The Krpano panorama viewer has been used in order to include interactive nodes, so called hotspots, which allow the user to perform many functions such as activating or deactivating the visualization of superimposing layers. Thereby, an interactive web page has been created in order that the viewer may freely visualize the spherical panorama obtained from Google Earth and activate or deactivate the visualization of a layer containing Guesdon's picture, which would be properly placed over the panorama so that the user could compare these two historical stages. The interactive visualization is available through the internet following this link: https://pcabezos.webs.upv.es/vlc/rephoto.html or by reading the QR code in figure 11 using any mobile device.

Another result of this study consist of a video integrating the original lithography and the obtained spherical panorama, in order that the viewer may travel into the past being immersed in Guesdon's view,

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Fig. 11 - Equirrectangular image composed using Hugin from the partial views obtained with Google Earth. The interactive visualization is available through the internet by reading the QR code in the figure with any mobile device

while providing additional information about the architectural elements that have disappeared and those which still remain standing today, in order to recover the memory of the walled city of the 19th century.

This video is available to general public through YouTube by using the following link:
https://youtu.be/8Z9j-BH9Ko0

It can also be viewed from any mobile device when reading the QR code in Figure 12.

CONCLUSIONS

The use of new techniques such as rephotography and spherical panoramas have proved to be a very effective method for the urban diachronic analysis, since this combination may allow any kind of audiences to easily understand the urban evolution of the cities, while contributing to the dissemination of lost architectural heritage. The thorough analysis of the perspective using a specific designed methodology to carry on the restitution of the viewpoint has resulted very effective, allowing the user to accurately compare the current image of the city, obtained with Google Earth, and the picture showing the walled city, represented in the ancient perspective view by Alfred Guesdon. As a result of this research, an interactive visualization and an informative video have been created. These multimedia objects are very suitable for virtual musealization purposes and they have also been included in the exhibition promoted by the City Council of Valencia entitled: *Guesdon Ayer, Valencia Hoy. La imagen de la ciudad*, held between March 1 and May 27, 2018 at the *Museo Histórico Municipal*.

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Fig. 12 - Frame of the video superimposing Guesdon's lithography over the spherical panorama. The entire video can be watched through any mobile device by reading the QR code in the picture

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NOTES

[1] Translated fragment from Marionneau (1876:487)

[2] See Stroffolino (2012)

[3] See Klett (1984) & Muybridge (1990)

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