

Accuracy analysis of the chorography of A. Wyngaerde's view of Zaragoza, 1563

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Abstract:

There are very few examples of old graphic documentation about cities. However, their usefulness for the study of urban evolution and for the creation of historical cartography stimulates their study. One of these cases is the panoramic view of Zaragoza made by Anton van den Wyngaerde in 1563. A detailed analysis of this graphic document is conducted by this research as a primary source for a comparative study of the urban structure of the 16th-century Renaissance city with present-day Zaragoza. The results obtained highlight the transformation of the city's urban form. To evaluate the fidelity of the drawing, the technique used by the author has also been analyzed, together with the quantification of the distortions and deformations applied as an artistic practice in this drawing. As a result, a measure of the accuracy of the drawing is obtained, allowing for reliable conclusions about the validity of the information provided by this old panoramic view for the study of the city at that time.

Keywords: old cartography, urban history, panoramic view, Anton van den Wyngaerde, chorography

1. Introduction

The historical period known in Spain as the Golden Age was one of the most important eras of artistic, knowledge, and thought creation in the history of the country. This cycle coincided with the peak of the Spanish Empire during the reign of Philip II, characterized by the territorial expansion of the House of Habsburg. However, the king did not neglect his heritage and was very active, standing out in domestic policy where he enacted significant administrative reforms, including some innovations in architecture with commissions such as the Monastery of El Escorial, the Cathedral of Valladolid, or the Citadels of Pamplona and Jaca. He was also a patron of mathematical, geographical, and engineering projects. In this context, Anton van den Wyngaerde, court painter of the Crown, was commissioned to travel, mainly across the peninsular territory of the country, creating landscape views of the main Spanish towns. The Flemish artist developed a total of 62 drawings, corresponding to 58 locations, which today allow us to see how the appearance of the depicted cities and towns. This research focuses on the panoramic view created by the painter of the city of Zaragoza in 1563, during his second journey through the territories of the Crown of Aragon, a conglomerate of ancient kingdoms in the northeastern region of the country.

The document provides a panoramic view of the city from the north bank of the Ebro River, revealing remarkable details. The most significant civil and religious buildings are easily identifiable, and several of them are accompanied by annotations for their precise identification. Nearly five hundred years later, some urban

elements remain unchanged. Meanwhile, in the case of buildings that no longer exist, historical documents provide precise information about their original location and dimensions before their disappearance or transformation. Thanks to this information, the methodology used in creating the drawing and the authenticity with which the Flemish painter worked can be deduced. With the exception of compositional liberties, which will be discussed later, or any errors in the process, the painting can be regarded as a faithful representation of the city's condition in that time.



Figure 1. Detail of the landscape view of Zaragoza by Anton van den Wyngaerde. Source Österreichische Nationalbibliothek.

During the documentation process, only one research study on this Wyngaerde's chorography was found, conducted by Fatás and Borrás (1974). Since this study only addresses the identification of individual elements without examining the fidelity of the panoramic view, it has been deemed essential to conduct a more technical

study focused on the cartographic and chorographic information.

The view of Zaragoza composed by Anton van den Wyngaerde predates the first minimally accurate maps of the city by a century and a half. For this reason, it provides valuable insight into Zaragoza at its peak of splendor, growth, and luxury. In 1523, visitors to the city were so struck by its opulence that they referred to it as "la Harta" –meaning it exuded wealth– (Bas Carbonel, 1999). Thus, this interpretation reflects the grandeur of this Renaissance city, showcasing numerous architectural elements of great interest -many of which would later disappear and are no longer found in post-1711 cartographies.

1.1 Other material of study and background

The surviving graphic material depicting Zaragoza in the 16th century is limited and scarce. The old cartography consists of a sketch of the Torrecilla and Valmadrid mountains, illustrating the livestock paths departing from Çaragoça, which is stored in the Casa de Ganaderos Foundation archive. Additionally, there is an outline from the end of the century showing the city's layout, located in the General Archive of Simancas. The oldest known map, dating between 1605 and 1614, was created by a Jesuit priest and was recently found in Paris, as reported by García (2010).

Wyngaerde's drawing is part of the Villes d'Espagne collection, currently housed in the Austrian National Library in Vienna – Österreichische Nationalbibliothek – under inventory code Min. 41 HAN MAG. The full drawing measures 1415 x 423 mm and is spread across four sheets of paper that have been joined together due to its considerable length. The collection also includes other views of cities, landscapes and monuments, as well as some of the sketches that the draftsman used in the creation of these works. However, the only known sketch of this view of Zaragoza is part of another collection of views of Spain held at the Victoria and Albert Museum in London, ACCESSION-NUMBER: 8455:13. Additionally, some of Wyngaerde's panoramic views of Spanish cities are preserved in the Ashmolean Museum in Oxford.

While preparatory sketches or general urban space sketches, detail sketches, and similar works have survived for other cities, nothing has been preserved specifically related to Zaragoza.

Regarding the study of the drawing itself, only two publications are known to address it: the first and most recent is by Richard Kagan (1986), which covers the entire body of work produced by the Flemish artist during his travels. This work mentions Zaragoza briefly, commenting on specific details; the second publication is more focused it is a monograph on the panoramic view of Zaragoza by Fatás and Borrás (1974). In this book, the authors analyze the drawing, first providing a global overview and then studying each architectural element in detail. Additionally, research on Wyngaerde's panoramas of other Spanish cities, such as Barcelona (Bergada Casas, 2012), Valencia (Aldana Fernández, 1987), Granada (Espigares Rooney,

2015), or Zamora (Rodríguez Méndez and García Gago, 2014), has also been taken into consideration.

Historical research provides cartographic materials from both the same period and earlier, contributing to a notable body of historical cartography. In this context, we differentiate between *old cartography* and *historical cartography*, as defined by Edney (2020). Although many maps of the city from the periods immediately preceding the one studied here exist, the most relevant for this research is the map created by Falcón (1981). Falcón overlaid elements and street names from the second half of the 15th century onto Carlos Casanova's 1769 map, enabling the precise identification of many of the now-lost elements depicted in Wyngaerde's view.

2. Research objectives

The main intention of the study is to assess the accuracy and precision with which Anton van den Wyngaerde created his panoramic view of Zaragoza, in order to extract insightful information for the study of the urban history of the city. To achieve this, three specific objectives are outlined. First, the study aims to geographically locate both the viewpoint from which the drawing was made and the vanishing point of the perspective. Identifying the location, or narrowing down the area, from which Wyngaerde's perspective was taken is crucial for further investigation. The second objective is to identify elements that still exist and can be georeferenced within a Geographical Information System (GIS). This includes buildings and streets preserved in Zaragoza, as well as those whose exact location is known, even if they have disappeared. The drawing's elements will also be compared with contemporary geographical and population data to ensure consistency. Third, the study seeks to determine the technique used by Wyngaerde and assess the level of fidelity and precision of his work.

3. Methodology

The primary sources of information have been high resolution digital copies of original documents from the 15th to 17th centuries, Wyngaerde's 1563 view of the city, the historical map by Falcón, and the 1712 map of Zaragoza from the Army Geographic Center's collection. Subsequently, updated cartography was downloaded from the electronic site of the Cadastre, utilizing open data provided by the Ministerio de Hacienda –Treasury of Spain–, enabling a comparative analysis of past and present references. This comparison facilitates the accurate determination of locations or georeferences. To align the historical view with current images of Zaragoza, a three-dimensional survey of the used planimetry was conducted. The work of Fatás and Borrás (1974) has been instrumental as a supporting and reference document, as provides a comprehensive list of identifiable elements from the drawing.

3.1 Analysis at a glance. Detection of distortions.

Noticeable distortions become evident when comparing the drawing, the layout of the city, and the arrangement of buildings with both ancient and modern maps. These distortions are clearly part of the artist's effort to simplify and beautify the view. Before conducting measurements and validating the composition and perspective, it is essential to account for these deformations. The existence of a preliminary sketch of the drawing, along with a collection of other panoramic views of cities made for the king's commissioned work, greatly helps to identify the procedure used, thereby explaining many of the inconsistencies between the drawn view and the maps.

3.1.1 *Unattainable Point of View*

Wyngaerde depicts the city from a vantage point north of the Ebro River, situated several dozen meters above ground level. Attempts to accurately calculate the height of this viewpoint have been unsuccessful. It can be concluded that the panorama presented is implausible, as different sections of the drawing would require different vantage points. Specifically, the elevation of the viewpoint when observing the buildings in the foreground of the Arrabal neighborhood, north of the river, including the towers of the Church of San Lázaro and the Monastery of Jesus, is significantly lower than what is required to project the city center on the drawing surface while maintaining the proportions of height and width depicted. Indeed, when viewing the foreground tower, it appears to be observed from a position approximately three hundred meters from the riverbank and at an altitude no more than twice the tower's height, that is, between 50 and 100 meters. However, to achieve the view of the urban center with the same proportions on the drawing surface, the viewpoint would need to be elevated to over 500 meters. It is important to note that, since the drawing lacks perfect perspective coherence for each element, these values have been approximated through the generation of 3D city views based on map rendering. Specifically, cadastral maps were used, and views were generated using Autocad and Q-GIS software.

It is worth highlighting that at the location corresponding to the viewpoint, there is neither any natural elevation of the terrain nor any historical evidence of a structure tall enough for the artist to have observed the city directly. Therefore, it is clear that he employed a system of artificially raising the viewpoint. This is consistent with the preserved sketch, which resembles a profile drawing of the city seen from the opposite side of the river. It is well established, as noted by Espigares (2015), that Wyngaerde used this technique in situations where no elevated vantage points were available.

3.1.2 *Simplification of the City's Contour*

The depiction of the city south of the Ebro in Wyngaerde's drawing shows an elliptical shape that suggests an almost circular space, which does not reflect the real contour, which is more irregular with a ratio of 1 to 1.6. To determine this ratio, the maximum horizontal distance parallel to the river and the depth represented in the

perspective were calculated using two known reference lengths: the width of the river at the bridge and the distance between the Convent of San Agustín and the Convent of Predicadores. This simplification, reducing the city's form to an almost perfect circle to encompass its entire surface, is also evident in Wyngaerde's view of Valencia from the same journey collection. In that case, the distortion is less pronounced, since the real distance ratio is closer to 1. Conversely, in the case of Barcelona, he depicted the city within an almost perfect square, applying a similar scheme of enclosing the city in an idealized geometric shape. Other examples of this type of simplification can be found in Wyngaerde's panoramic views, with Medina del Campo and Zamora serving as notable examples.

This chorography prioritizes clarity in presenting the city's layout. Had he depicted a more realistic perspective from a lower viewpoint, the buildings would appear more closely spaced, resulting in an image resembling the profile in his sketch. By simplifying the shape of the city into a large, nearly circular ellipse, he creates a legible scheme of urban spaces. However, this simplification introduces some distortions.

The drawing surface is manipulated, deviating from a perpendicular alignment to the line between the viewpoint and the vanishing point. This adjustment allows the river to appear horizontal and the building facades to face forward. This stylistic resource creates a more harmonious composition, presenting convents and palaces frontally. It aligns with the preliminary sketch, where the entire city profile is shown in a unified way, suggesting that Wyngaerde likely moved along the north bank of the river, sketching the constructions from a consistent dihedral perspective. The representation of the Stone Bridge – Puente de Piedra – is particularly remarkable, depicted in profile much like in the sketch. This highlights his intent to clearly display the bridge to the viewer, prioritizing visual clarity over precise measurement accuracy. Thus, it can be concluded that, as an artistic chorography, it was never intended to serve cartographic purposes but rather to showcase the city and its features.

3.1.3 *Sizes and Proportions*

Returning to the deformation of the city's layout to inscribe it in a circular shape, several inconsistencies arise when compared to historical information about the city and its population. One notable example is the San Pablo neighborhood, which occupies the westernmost part of the city. In the drawing, it is positioned to the right of the main square and the perimeter of the ancient Roman wall. Wyngaerde's depiction assigns this neighborhood approximately one-eighth of the city's total area and residential buildings. However, in Martin's (1998) detailed analysis of the census data from 1495 and 1548 estimates Zaragoza's total population at 25,000, with 10,000 residents in the San Pablo neighborhood. This suggests the neighborhood should account for about 40 percent of the city's population, yet the drawing reduces it to just third of its actual size and number of dwellings. A similar discrepancy is found in the easternmost part of the La Magdalena neighborhood, located at the opposite end of

the city. Its dimensions are also significantly reduced in the drawing. This deliberate alteration of Zaragoza's shape, making it less elongated, affects both axes. The drawing increases the perceived depth while simultaneously reducing the width.

To further depict a more compact representation of the city, the Aljafería Palace appears much closer to the city wall than its true position. Drawing it in its actual location would have left a large empty space, likely requiring the drawing to be extended to accommodate San Lamberto to the right. By placing it near the current Santo Domingo Square, where the Convent of the Preachers once stood, the overall composition becomes more compact and balanced.

The sizes of several towers, churches, and palaces are notably disproportionate. This enlargement appears to have been applied intentionally to highlight the significance of each building within the city. For instance, the Luna Palace, which now houses the Audiencia, is depicted twice its actual size, while the Church of San Gil is shown at three times its actual size. The exaggeration of the cathedral, La Seo, is particularly striking. Its dome is portrayed as enormous, far exceeding its real proportions. However, in the preliminary sketch, the cathedral is shown with a relatively accurate configuration and size. In the final work, Wyngaerde alters, embellishes, and enlarges the cathedral to evoke the image of the *Templum Domini* or Temple of Solomon. This aligns with late Middle Age and Renaissance iconography, reflecting Zaragoza's symbolic role since King Alfonso I's conquest, which sought to restore the city to Christianity. A symbolic place is built in the tradition of Roman topia (della Dora, 2013).

3.2 Comparison with Current 3D View

Given all the liberties Wyngaerde took in his drawing, it is clear that comparing it to a 3D view will reveal significant differences. All attempts to adjust the positions of the elements in the drawing have been unsuccessful. Initially, the drawing was tilted to create a map, and the precision of the inverse perspective calculation for this purpose was likely not a priority, since the goal was later to geo-reference it using the QGIS software, updated cartographic data, and equivalences for buildings that no longer exist. The conclusion, however, was that geo-referencing the drawing is impossible. The positional errors exceed any acceptable margin, and there are notable inconsistencies in the relative positions of buildings.

Figure 2 shows a comparison between a fragment of the view and a 3D rendering, using a viewpoint that maintains an equivalent proportional relationship of the city center. The three buildings marked in blue, visible in both views, serve as reference points. Although these buildings have been modified over time, they have retained their size and remain in the same location. The relative positioning of these three buildings is consistent in both views. However, the placement and sizes of other elements do not align. In the current view, the locations and sizes of the elements that are obscured behind larger or nearer buildings have been marked to indicate where they should appear.



Figure 2. Variation in the arrangement of certain elements in Wyngaerde's chorography. A comparison with a 3D view using an equivalent perspective.

Observing the fairly accurate alignment of La Lonja –29–, San Gil –25–, and Santa Engracia –20– while La Magdalena –8– appears shifted to the left or the Santo Sepulcro –9– to the right, it can be inferred that this effect is either a result of distorting the city's perimeter or that Wyngaerde used at least two different viewpoints. This technique of using multiple viewpoints is present in other works by Wyngaerde. This method was first documented by Espejo (1908), Rodríguez and García (2014) and Rutte (2020). It is important to note that the preparatory sketch must have been made from different viewpoints, since the entire line of buildings in the city's profile is shown facing the observer, parallel to the drawing surface. The displacement of La Magdalena –8– is indeed due to this technique and it is evident that it has been shifted beyond El Coso street, which corresponds to the path of the ancient roman wall.

One indication that the differences between the drawing and reality are intentional is the depiction of the La Lonja building, shown in its entirety without any other buildings obstructing it. To achieve this, the Municipal Government Houses –Casas de Gobierno del Municipio– were omitted from the drawing, ensuring that this significant, newly constructed building would not go unnoticed (Gómez, 2024). It is likely that other buildings were either removed or their sizes reduced to improve the clarity of the view. Similarly, some of the building relocations were undoubtedly made to avoid visual overlaps, such as the slight shift of the church of San Felipe, which would otherwise have been almost entirely concealed by the Torre Nueva.

3.3 Cartographic analysis of the chorography

Despite the previously identified inaccuracies, errors, and intentional alterations in the chorography, a calculation was performed to identify the principal viewpoint—the one that most accurately aligns with the majority of elements in the view." To this end, the vanishing point and

current cartographic data were considered, along with the coordinates of buildings that remain unaltered or whose locations are precisely known. This approach enabled the quantification of deviations from the ideal theoretical proportions on the drawing surface. Buildings have been classified into three categories, based on the identification of buildings by Fatás and Borrás (1984). Precise location references clearly depicted in the drawing are required. Therefore, a first set of buildings that have either remained largely unaltered or have been replaced by reconstructions or equivalents on the same site have been selected, providing reliable reference points. This includes, for example, the church of Santa Engracia, rebuilt in the 19th century, and the Puerta del Carmen, constructed in the 18th century. This first group is classified as *I* –invariant–.

A second group of buildings that, despite retaining some original parts, have undergone significant transformations over the past five centuries, making them unsuitable as reference points, have also been identified. This category is labeled *M* –modified–. The final category, *D* –disappeared– includes buildings that, despite having documentation that could allow for geo-referencing, are not used as references due to their absence.

Additionally, a series of invariants independent of the buildings have been identified, which also facilitate the study of the view and its evolution. These elements include the courses of the Ebro and Huerva rivers, the stone bridge –the only one in Zaragoza at the time of the author's visit–, the section of the wall near the convent of San Agustín, and the urban layout, which has been preserved in the modern street map. Notably, the city's population in 1563 was estimated at 25,000 inhabitants and was undergoing growth. Currently, Zaragoza has 694,109 inhabitants and spans an area more than eight times larger, excluding the peripheral neighborhoods.

The identification of viewpoints and vanishing lines requires a prior analysis of the drawing technique employed by Wyngaerde in his landscape views. This involves studying and understanding the draftsman's methodology. One of the conclusions from our initial analysis is that Wyngaerde used tilt and perspective techniques.

Certainly, he must have used a map of Zaragoza. However, we cannot determine which one or assess its accuracy, as no old maps from that period have been preserved, apart for the aforementioned sketch by a Jesuit (Figure 4). We can only speculate whether he relied on a minimally accurate map or merely on a schematic representation similar to that sketch. If it were the latter, some of the distortions in the city's shape and its circular outline might stem from this source, rather than being purely artistic licenses. Frangenberg (1994) faces a similar problem in his analysis of views of Florence.

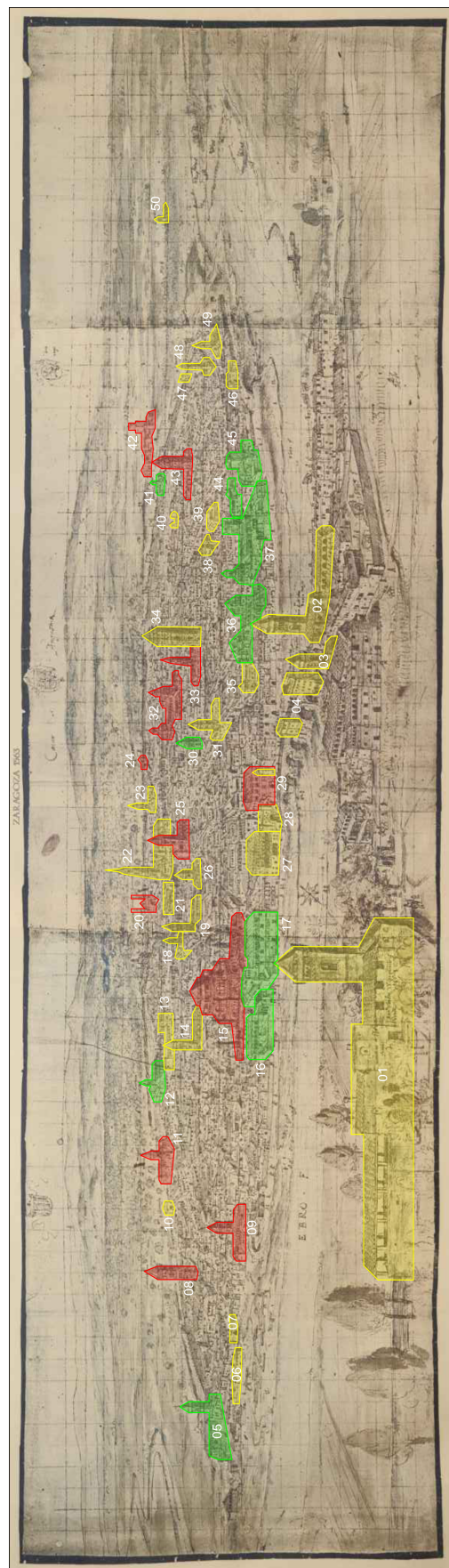


Figure 3. Identification and categorization of buildings (red: invariant; green: modified; yellow: disappeared). Base image Source Österreichische Nationalbibliothek.

#	Element	Class	Cat.
1	De Jesús	<i>Mnt</i>	D
2, 3	Altabás, S. Lázaro	<i>Cnv</i>	D
4	Torres	<i>Adm</i>	D
5	San Agustín	<i>Cnv</i>	M
6, 7	Tenerías, Sol	<i>Gt</i>	D
8	La Magdalena	<i>Ch</i>	I
9	Sto. Sepulcro	<i>Cnv</i>	I
10	Quemada	<i>Gt</i>	D
11	San Miguel	<i>Ch</i>	I
12	Santa Catalina	<i>Ch</i>	M
13	Protonotario	<i>Plc</i>	D
14	San Lorenzo	<i>Ch</i>	D
15	La Seo	<i>Cth</i>	I
16, 17	M. Almonacid, P. Arz.	<i>Plc</i>	M
18, 19	San Andrés, S. Juan vj.	<i>Ch</i>	D
20	Sta. Engracia	<i>Cnv</i>	I
21	N.S. de Gracia	<i>Hsp</i>	D
22, 23	S. Francisco, El Carmen	<i>Cnv</i>	D
24	Pta. Carmen	<i>Gt</i>	I
25	San Gil	<i>Ch</i>	I
26	San Pedro	<i>Ch</i>	D
27	Generalidad	<i>Adm</i>	D
28	Del Ángel	<i>Gt</i>	D
29	La Lonja	<i>Adm</i>	I
30	La Santa Cruz	<i>Ch</i>	M
31	Santiago	<i>Ch</i>	D
32	C. Morata	<i>Plc</i>	I
33	San Felipe	<i>Ch</i>	I
34	Torre Nueva	<i>Adm</i>	D
35	M. Torroces	<i>Plc</i>	D
36	El Pilar	<i>Ch</i>	M
37	M. Ayerbe	<i>Plc</i>	M
38	Pta. Toledo	<i>Gt</i>	D
39	Cárcel	<i>Adm</i>	D
40	Santa Inés	<i>Ch</i>	D
41	El Portillo	<i>Ch</i>	M
42	La Aljafería	<i>Plc</i>	I
43	San Pablo	<i>Ch</i>	I
44	La Zuda	<i>Adm</i>	M
45	S. J. Panetes	<i>Ch</i>	M
46	D. Villaherm.	<i>Plc</i>	D
47	Sancho	<i>Gt</i>	D
48-50	S. Luc., Pred., S. Lamb.	<i>Cnv</i>	D

Table 1. List of identified elements, their classifications, and assigned categories. (Mnt: Monastery; Cnv: Convent; Adm: Administrative; Gt: Gate; Ch: Church; Plc: Palace; Hsp: Hospital)

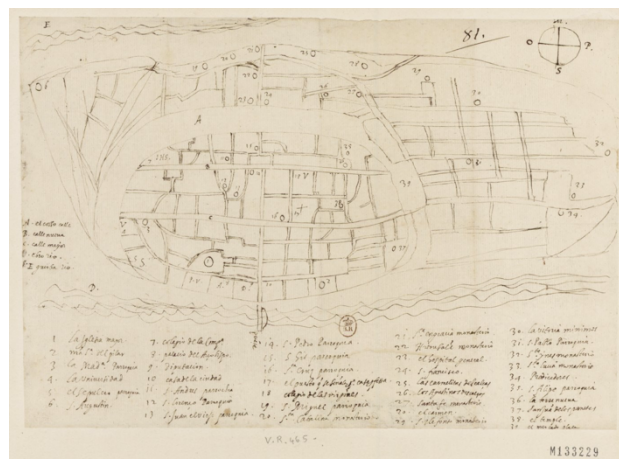


Figure 4. Oldest known map of Zaragoza, sketched between 1605 and 1614. Source gallica.bnf.fr / Bibliothèque nationale de France.

To apply the required tilting and perspective techniques, Wingaerde would have followed these steps in his studio work: 1. Identify the viewpoint and trace the vanishing lines; 2. Draw the northern profile of the city from a bird's-eye view; 3. Adjust the horizon line using the flattening technique; 4. Divide the city into independent sectors based on the urban layout; 5. Position and draw the key elements within each sector; 6. Add less prominent residential buildings, distributed across three or four different depths; 7. Complete the final composition by assembling all sectors.

We have applied a five-phase method to identify the main points and lines: 1. Identify the viewpoint and draw the parallel lines in perspective; 2. Divide the city into independent sectors based on the urban structure; 3. Draw the northern façade of the city from a high vantage point; 4. Add the characteristic elements of each sector; 5. Populate the drawing with buildings, distributed across four depth ranges.

To determine the approximate location of the viewpoint within the current layout of Zaragoza, we have used cartographic data to plot visual axes in the x - y plane, aligning them with the locations of invariant elements. Several alignments are identified in this process, such as the alignment of La Seo with the now-demolished Hospital de Gracia (the site of the current Bank of Spain). Another notable alignment is that of La Seo with the Church of San Gil and the Puerta del Carmen. The lines used to locate the viewpoint are referenced based on the orientations of the façades of the building towers. While several have disappeared, their locations are known and are used solely as visual references in Wynaerde's composition. Through these operations, the viewpoint can be approximated to a specific geographical location. However, the precision of this point has an inherent limit, given that the view contains intentional inaccuracies and errors.

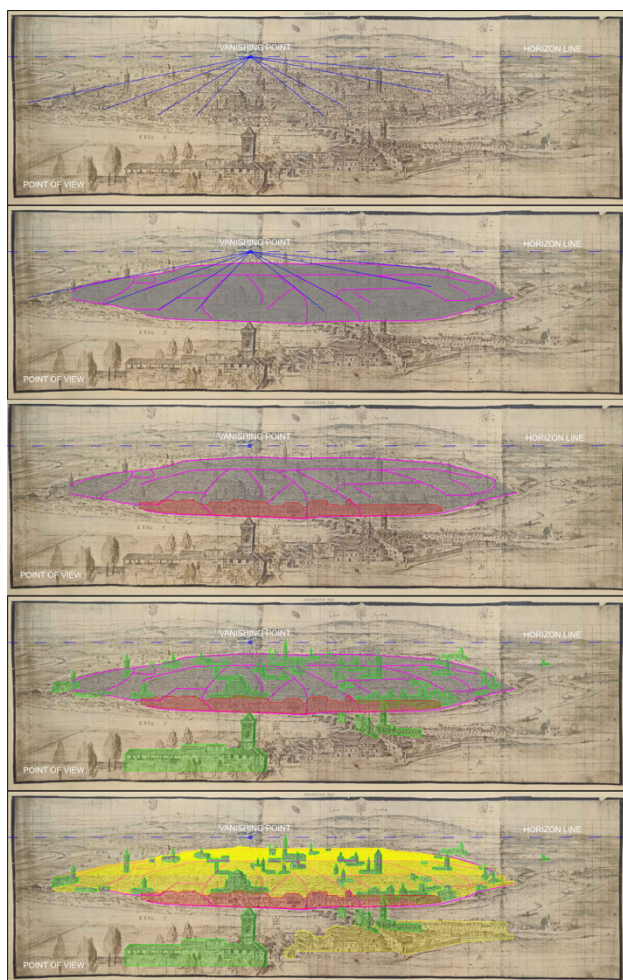


Figure 5. Evolution of the method to identify elements and recreate Wyngaerde's process in five phases.

To resolve the z-axis variation, it is necessary to refer to a three-dimensional survey of the planimetry, focusing on buildings that have survived to the present day. From this, the silhouette can be obtained and compared with the chorographic representation to identify any possible distortion or height adjustment in the buildings depicted in the drawing. By confirming any such distortions, we can assess the accuracy of the perspective applied by the author at the time.

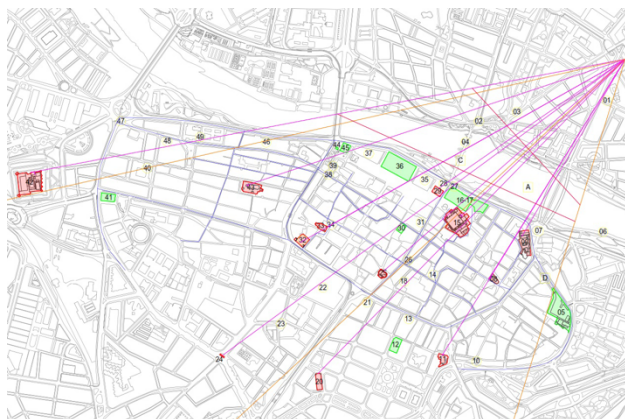


Figure 6. Plan of the city with visual axes, reference lines and the identification of theoretical and applied drawing planes.

Figure 6 represent the parallels to two drawing surfaces. The first was obtained by applying the perspective we deduced and is perpendicular to the axis connecting the viewpoint and the vanishing point. Since Wyngaerde depicts a view in which the line of facades on the north side of the city appears horizontal, despite this causing a distortion of the view, we also consider a plane parallel to the river. Thus, we take both surfaces into account. The angle between the two is 23° . By measuring the distances at which the straight lines connecting the viewpoint with each visual line intersect, we can assess the accuracy of the drawing in relation to the proportional distances. For this purpose, we use the point where the central axis intersects each drawing surface. We arbitrarily select the horizontal distance between this point and the visual line to the Church of San Pablo –43– as our reference. By calculating the proportions between this value and the distances to other buildings, we compile Table 2, which compares the theoretical ratio on the correct drawing surface, the ratio using the distorted surface, and the ratio on Wyngaerde's view. Because the central axis passes over La Seo –15–, its ratio is always 0. For San Pablo, as it is our reference point, the ratio is defined as 1.

#	Distance ratio			Deviation	
	A	B	W	A	B
8	-0.61	-0.44	-0.64	-0.03	-0.20
9	-0.67	-0.48	-0.54	0.13	-0.06
11	-0.61	-0.44	-0.40	0.21	0.04
15	0,00	0.00	0.00	0.00	0.00
20	-0.11	-0.09	0.11	0.22	0.19
24	0.25	0.21	0.39	0.14	0.18
25	0.06	0.05	0.23	0.17	0.19
29	0.31	0.27	0.31	0.00	0.05
32	0.53	0.47	0.50	-0.02	0.03
33	0.53	0.47	0.60	0.07	0.12
42	1.38	1.52	1.07	-0.31	-0.45
43	1.00	1.00	1.00	0.00	0.00

Table 2. Deviation in the ratio of the horizontal distances to the central vertical of the elements in the view. (A: perpendicular plane; B: distorted plane parallel to the river; W: old drawing). Ratios are calculated as the distance to the element divided by the distance to San Pablo (# 8).

Table 3 depicts the ratio between the horizontal distance to the center point and the reference for both theoretical drawing planes. The same calculation has been applied using distances from the old chorography. Since distance ratios in the theoretical drawing surfaces are based on accurate coordinates, as shown in Figure 6, we can determine the real deviations in Wyngaerde's view.

The reference distance used is approximately 21 percent of the total width of the view, excluding margins. Therefore, the deviation value represents a portion of that distance. For example, La Magdalena –8–, when compared with the perpendicular theoretical drawing plane, is shifted to the left by 0.6 percent of the image width. Upon examining the obtained values, it is not obvious whether the autor used system or another to calculate the view's metrics.

However, the values highlight some of the distortions that we have detected.

La Magdalena and its surrounding elements provide a clear example. Its location in the view is quite accurate, yet it is not placed on the street where it should be. In fact, it appears to be drawn in the next sector of the city, beyond Coso street. This distortion becomes clearer when we observe that Santo Sepulcro –9– has been shifted in the opposite direction by more than four times the distance. The same applies to San Miguel –11–. This indicates that the elements near the perimeter are significantly displaced, with the deviation increasing the further they are from the center.

This is the obvious effect of forcing the city to be depicted in a circular form. Much like a morphing process, Wyngaerde manipulates the position of certain buildings to conform to the *ad circulum* system, adhering to classical and renaissance traditions. As noted earlier, in the same collection of drawings, *ad quadratum* is applied to Barcelona.

4. Conclusions

Although the drawing provides valuable insight on the city's structure, streets, and the relative positions of buildings, it lacks the precision required for comparing distances and angles with exact cartographic measurements.

Wyngaerde applies artistic licenses to embellish the view and emphasize particular city features. The most significant of these is the modification of the city's plan shape to create symmetry. There may also have been an intention to simplify the drawing for easier interpretation. In any case, the influence of Renaissance ideas and Vitruvian architectural forms is evident in the artist's style. The perspective in the drawing reveals a main viewpoint and a vanishing point, but a closer analysis shows that he used multiple viewpoints to compose the work. This variation is also reflected in the height of the viewpoint, which is lower for foreground elements.

A clear disproportion is evident in the size of several churches, convents, and palaces. In other cases, however, he maintains correct proportions, emphasizing the significance of certain elements of the city.

The buildings that have been preserved, or for which we have other graphic materials, are accurately represented in the drawing. The only exception is the depiction of a giant cathedral, with an enormous dome, more akin to the myth of Solomon's Temple than to reality.

The technique Wyngaerde used to create the view, beginning with a draft of the front facades from the north, has been verified through the reconstruction of the process using digital methods.

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