

The Model of Cadiz: a Unique Prototype for the Representation of Spanish Cities at the End of the 18th Century

Nicolás Gutiérrez-Pérez, Isabel Artal-Sanz, Tomás Abad, Pilar Chías

Abstract

Once he assumed the Spanish throne after his reign in Naples, Charles III began an ambitious project for the elaboration of a set of models of the most important strongholds in Spain, in order to facilitate the comprehensive understanding of these cities and as a means to make proposals for improvement, mainly in their fortifications. The first project was developed in the city of Cadiz –the main commercial port of the Indies and strategic enclave of the country– between 1777 and 1779, under the direction of Francesco Sabatini, Royal architect, who appointed Alfonso Ximénez, military and model maker, to execute it in the city together with a large multidisciplinary team. As a result, they made a model larger than 100 m² of surface at $\pm 1:250$ scale, using noble materials, such as different types of wood, ivory, and silver, constituting an exception among the urban models that had been made so far, both for its size and richness, as well as for its level of abstraction. In this article we will approach this singular and unique exercise by contextualizing it in the European panorama of the time, as well as through its analysis and three-dimensional survey, which will offer new perspectives and will allow us to contrast its accuracy and relationship with historical cartographies, in order to finally value and vindicate the exceptional nature of this graphic contribution in the form of a model.

Keywords: model, Cádiz, prototype, Charles III, survey.

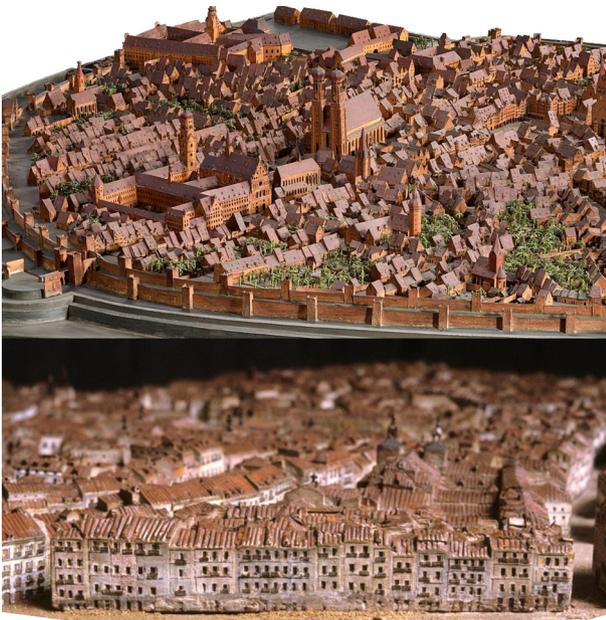
Introduction and precedents

The use of the model as a support for graphic expression is a fundamental practice in the discipline of architecture because it allows a three-dimensional and holistic view of the object represented. Likewise, its ability to visualize, check and experiment on the model makes it a particularly useful element for design and construction, in the same way, allows it to be understood in an accessible and intuitive way by the majority of publics and clients [Carazo Lefort 2018]. In this sense, the use of the model took on special relevance in the Renaissance, becoming a product especially requested by patrons of the arts as a means to obtain an image of the final state of their commission [Franco Taboada 2018]. In this period, stand out the wooden models produced in the city of Florence for the

competition to design the façade of the cathedral or the model of Brunelleschi's dome which, in addition to being a visual approach, was a tool for understanding the construction process (fig. 1) [Millon 1994]. In the Spanish context, and with the same objectives, highlights the preserved project model of the current Prado Museum (originally the Natural Sciences Cabinet), made with different types of noble woods around 1786 and which allows to observe and understand its interiors by uncovering the roofs and disassembling all its elements [Maure Rubio 2021]. In addition, the use of the model also served as a means to objectify an element of reality in order to record its morphology to obtain a comprehensive –and at scale– vision and mastery of it, without any other purpose related to a

Fig. 1. Model for Brunelleschi's dome (1419-1436) and Giambologna's proposal for the façade of Florence Cathedral (1586-1589). Museo dell'Opera del Duomo, Florence.

Fig. 2. Top: Model of Munich (1570), Bayerische Nationalmuseum, Munich. Bottom: Model of Madrid (1830), Museo de Historia de Madrid, Madrid.



design process. As an example, in the 16th century a desire arose to represent cities volumetrically through models, both for strategic-military purposes, as well as for the eagerness of some monarchies to possess a scalar reproduction of their urban and territorial domains [Buisseret 1988]. In Europe, the models of the Bavarian capitals commissioned by the Duke of Bavaria stood out –among them the model of the fortified city of Munich made in 1570 (fig. 2), the oldest preserved– which as a whole were made of linden wood and, on this support, painted to differentiate the distinct types of elements represented: roofs, facades, terrain, etc. [Reuther 1974]. In the Spanish context, there is also evidence of a large collection of urban models of military character belonging to Philip II, which were kept in the Royal Alcázar of Madrid, during the second half of the 16th century [De la Torre Echávarri 2014].

At the end of the 17th century, the most notable collection of urban models in terms of volume was that of the French monarchy, which turned these objects into true elements of consultation that were indispensable for plotting any military strategy [Warmoes 2018]. In this case, models reproducing castles and fortified cities were promoted, including in them the territorial context as a means of recording the orography of the terrain, fundamental for the development of battles. The scale of representation used was 1:600, whose definition adequately met the objectives set, and they were made under the direction of topographers and geographers [Salerno 2019]. The material used to make these models was wood for the base, as well as cardboard, painted paper, metal and silk for the rest, which would give an ephemeral character to these representations, leaving open the possibility of making modifications later and also assuming a particularly realistic aesthetic in the graphic expression. Henceforth, the production of urban models with a realistic vocation of great quality and rigor would continue, for example, in the Spanish context with the model of Madrid by León Gil de Palacio made around 1830 (fig. 2) [Álvarez Barrientos 2016].

In short, and in general, we find two types of model representations during this stage: on one hand, those made with noble and solid materials –such as wood– which were mainly used for the presentation of buildings or certain parts of them prior to their construction, possessing a marked character of abstraction due to their dematerialization; and, on the other hand, those made with humble and ephemeral materials that were painted meticulously –hiding their true nature– and whose vocation was to

Fig. 3. General view of the model of Cadiz (Museo de las Cortes de Cádiz). Photo by the authors.



realistically convey the material and superficial qualities of the objects represented, which were essentially cities. The project that concerns us, the model of Cadiz made between 1777 and 1779 (fig. 3), cannot be fully inscribed in the latter case, because although it is an urban model, its materiality resembles the building models of the architectural scale. That is, it represents an existing object and also assumes the abstraction or dematerialization prototypical of projection models. In fact, this model advances even further on the exposed archetypes, since it introduces materials of great richness, being a unique example in terms of its value and the abstract conjunction of materials, moving us to another typology of objects close to the sumptuary. Also, through the 3D survey of the model carried out, which offers us the possibility of viewing the floor plan of the model, we can compare the accuracy of the exercise according to the current morphology of the city and the historical cartographies of the time.

The first prototype for a Fortification Cabinet

The idea for the creation in Spain of a “Cabinet of Fortification” [1] during the Enlightenment was born in the Crown during the reign of Charles VII in Naples and, specifically, after accessing the collection of models that the Duke of Noja, Giovanni Carazza, presented to him in 1744. A set of 10 military representations of cities and fortifications of the kingdoms of Naples and Sicily made in wood, cork and painted plaster, most of which are preserved scattered in various Italian museums [Viganò 2007]. Later, once he assumed the Crown of Spain, this monarch –now, as Charles III– will find much utility in the models made by the infantry captain Alfonso Ximénez around 1774 of the Spanish fortifications in North Africa, that served as support for its defense during this period of great tension with Morocco [Muñoz Corbalán 1999]. After these events, the King promoted the construction of models of the main fortifications and strongholds of Spain as a means to understand, confront and improve the defense of these enclaves in anticipation of future enemy attacks. The director of the project promoted by Charles III was the Count of Rical, Minister of War, who proposed the architect and military engineer of the Royal House and responsible for the great urban and architectural reforms of Madrid, Francesco Sabatini, to be in charge of its execution [2]. After observing the last models mentioned, he

appointed Ximénez himself as the person commissioned to create this collection of plan-reliefs of Spanish fortifications “such as all the Sovereigns of Europe already have” [3] and, after that, they selected the city of Cadiz to develop the first model and prototype due to its importance as the main commercial port of the Indies and strategic enclave of the country (fig. 4).

The work began in 1777 once Ximénez moved to Cadiz and selected the team of local masters –cabinetmakers, sculptors, measurement assistants, etc.–, although the project management considered the possibility of producing it directly in Madrid –the place where the model was to reside after its completion– and finally discarded it because of the higher economic cost [Martínez Montiel 1999]. This condition of mobility of the model was one of the most important and controversial factors when determining its scale, since initially the scale $\pm 1:190$ –“12 rods for every 3 fingers”– was considered and worked on, to finally adopt by agreement between Sabatini and Ximénez the scale $\pm 1:250$ –“7 rods per inch of Castile”– which would provide a smaller model [4]. In spite of this, the resulting model

Fig. 4. View of the model of Cadiz (Museo de las Cortes de Cádiz) with the Puertas del Mar (Sea Gates) in the foreground, next to the plan of its project in 1736. Photo by the authors and AGS, MPD, 53, 055.





Fig. 5. Castle of San Sebastian in the model (in blue) with respect to its original position (in colors). Graphic elaboration by the authors over historical cartography of the 18th century (AGS, MPD, 18, 233).

would not respond effectively to this premise, since its final measurements were 13.4×7.5 m on surface, forming a vast area of just over 100 m^2 which, due to its dimensions, would cause numerous logistical and spatial problems. Likewise, this distance from the Court and from Sabatini's direct supervision offered Ximénez a freedom of action that, in effect, he would use to give shape to a prototype of the ideal model from the technical and artistic point of view, to the detriment of the premises of mobility and flexibility agreed upon during the commission. Finally, the model was finished in 1779 and moved during the month of May to Madrid, where it was installed in the distinguished Salón de Reinos of the Royal Palace of

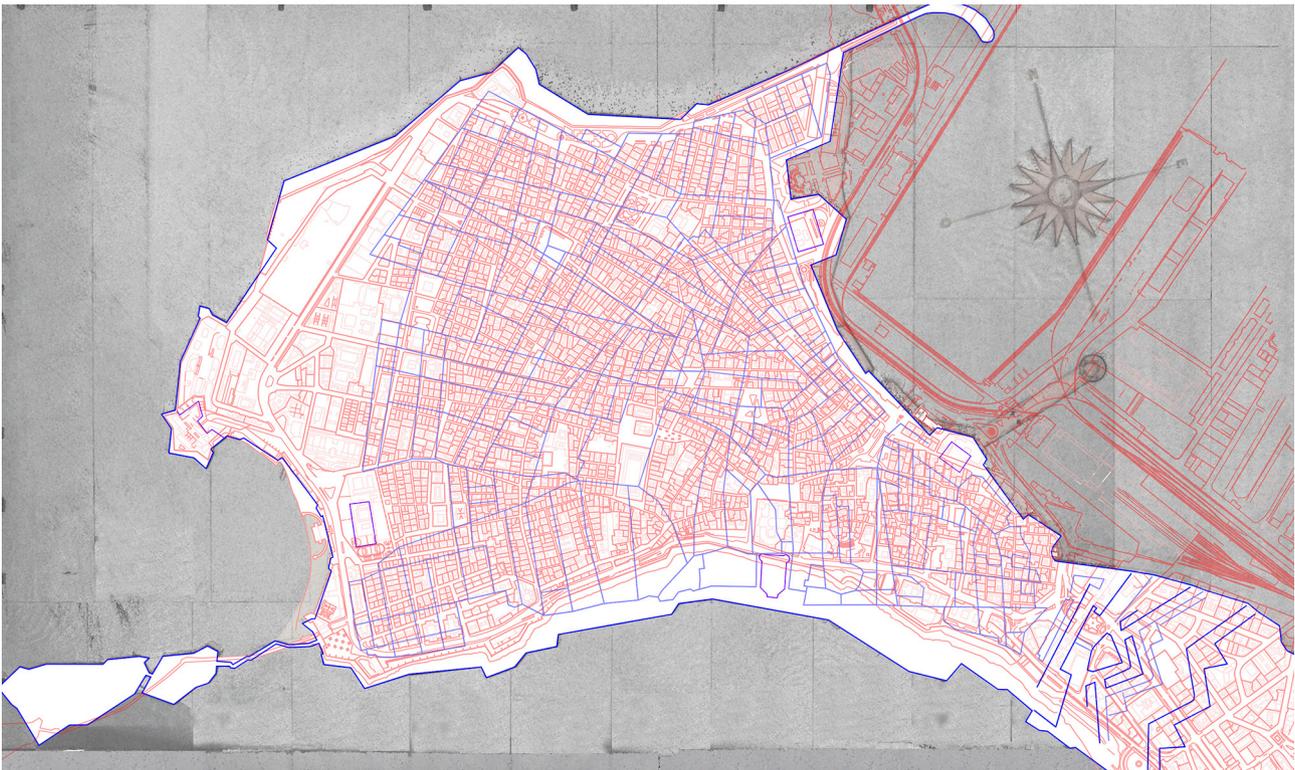
Buen Retiro [5]. There it was presented to the King and the Prince, who were fascinated by Ximénez's work: "H.M. with H.R.H. Prince Augusto spent an hour and a half filling me with incredible honors, until the King put his hand on my shoulder" [6]. However, the very high cost of the model – $176,104 \text{ reales de vellón}$ – [7], its practical immovability due to the complexity and the expense incurred for its displacement from Cadiz –both for its fragility and its dimensions and weight–, as well as the inability to introduce modifications on such static supports, led to the definitive conclusion of the project of the Cabinet of Fortification [8]. Finally, in 1889 the model returned to the city of Cadiz, where it is currently exhibited in the Museo de las Cortes.

Development and accuracy of the model

The work process developed by Ximénez began with the field work carried out by himself accompanied by two assistants for the survey plans and two masons who took the dimensions of the buildings and streets with specific measuring instruments for fortifications. Ximénez also had a camera obscura that he could place in the highest points of the city, in which there were numerous towers for the sighting of ships coming from overseas, as well as a field shelter to protect him from inclement weather while he made the drawings [9]. After carrying out the survey, he transferred the orders for their reproduction, personally supervising and correcting their development.

Likewise, there is no documentary evidence that Ximénez used the existing military cartography of the city, whose production was especially prolific during the 18th century due to the different fortification projects that were planned and developed at that time [Chías Navarro, Abad Balboa 2011]. On the contrary, and although they could serve as a reference, the author made new surveys of the fortifications: (on the ground) "I have continued cutting an infinity of profiles, and elevations and where these have not been sufficient, I have proceeded to the copy of the ground in wax that increases the perfection I desire"; (in the workshop) "immediately from the Maestranza to direct the cabinetmakers; either drawing the figures on the wood, or adjusting myself their plans, and thicknesses; and in such delicate matters; and small, I do not pass them the

Fig. 6. Superimposition of the scan of the model and its drawing (in blue) on the current cartography of Cadiz (in red). Graphic elaboration by the authors.



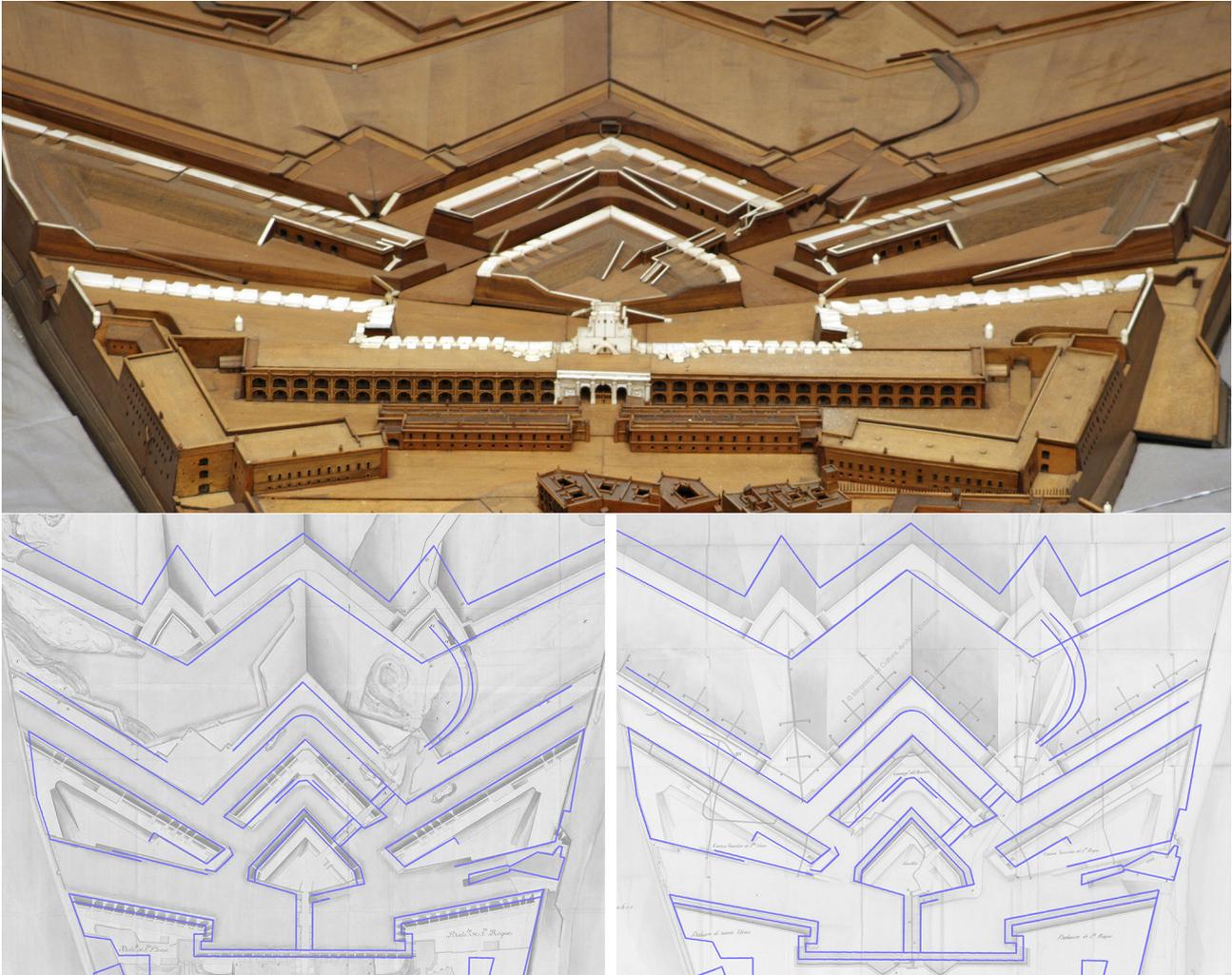


Fig. 7. Top: View of Puerta de Tierra (Land Gate) of the model of Cadiz (Museo de las Cortes de Cádiz). Bottom: Superimposition of the model survey (in blue) on the historical cartography of 1750 (left) and 1798 (right). Photo and graphic elaboration by the authors over AGS, MPD, 53, 034 and 57, 040.

most despicable"; (and, in short), "I do not hesitate a foot difference nor the smallest point of its original" [10]. The verification of the precision and accuracy of the model as a whole cannot be fully carried out today because it returned to Cadiz in very poor condition and was repaired –and transformed– intensively. In addition, it was again profoundly altered in the urban area and reduced in size to allow it to fit in the spaces intended for its musealization [Garófano Sánchez 2022; Granado Castro, Barrera, Aguilar Camacho, 2016]; therefore, the measurements of the current model are 10.80 x 6.45 m, 31% less than the original. One of the elements altered situationally is the Castle of San Sebastian, which approached the city during this reductive process (fig. 5).

During the research we have surveyed the model by laser scanner as a means to check its correlation with the plan of the present city and its fortifications [11] (fig. 6). In general,

the plan corresponds quite accurately with the current maritime border –especially in the western, northern and eastern fronts– and, on the contrary, there is a significant mismatch with the sea line in its southern front, where the Cathedral is located. Likewise, the city's urban layout is precise and corresponds to the current urban grid –with some exceptions and slight mismatches– in the space delimited by the aforementioned coincident fronts; the greatest errors occurring in the space adjacent to the Cathedral, as well as to the great fortification of Tierra –located to the southeast of the city–. In any case, and taking into consideration the magnitude of the model, we can conclude that Ximénez's representation is highly coincident with reality and, from our point of view, it is possible to attribute these discrepancies to the transformations produced in the model after his return to Cadiz; due to the rigor with which the author developed all his work, as we point out below.

Fig. 8. Comparison between the 1775 project for the New Cathedral represented in the model of Cadiz (Museo de las Cortes de Cádiz). ETSAM Library, AG_0072-01 and photo by the authors.

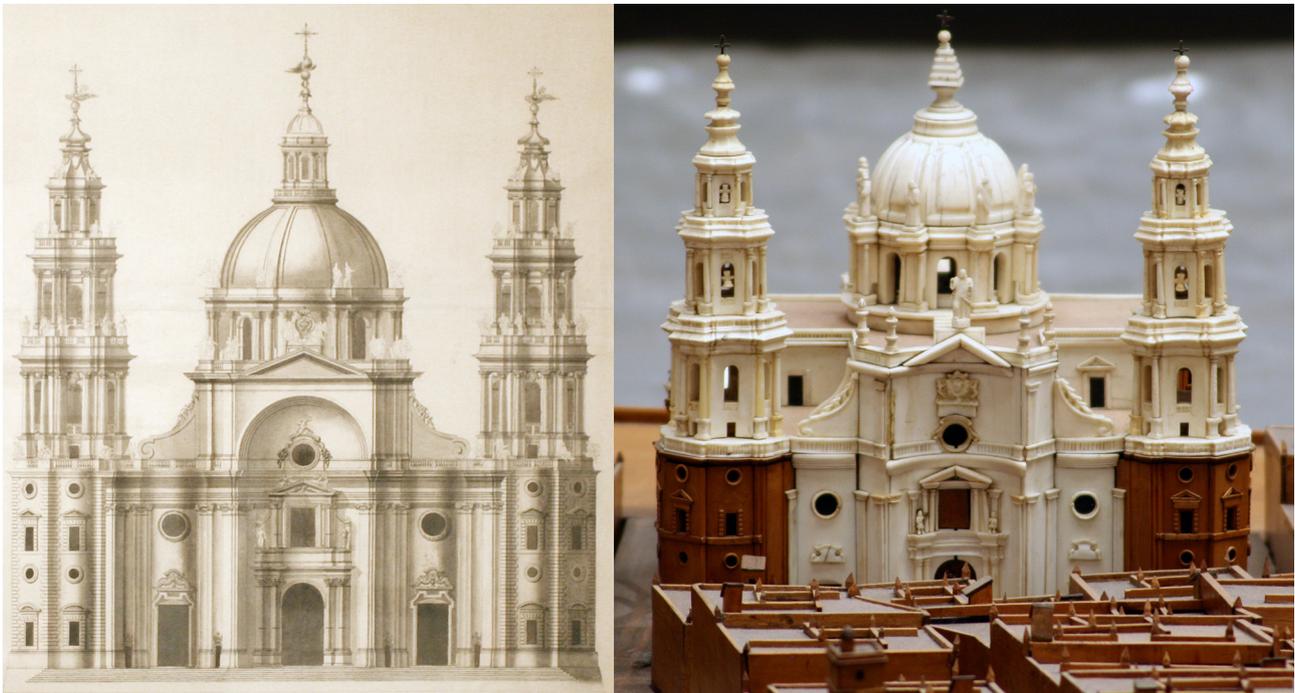




Fig. 9. Details of different buildings and objects of the model of Cadiz (Museo de las Cortes de Cádiz). Photo by the authors.

On the other hand, and because of the demolition of some of the buildings recorded by Ximénez in the model, it is not possible to confront their accuracy with the current planimetry –specifically the case of the important walls of the front of the Puerta de Tierra, the only land connection with the Peninsula, and in which the author put special effort– and, therefore, we have resorted to the cartography of the time. Specifically, and due to the improvement actions to which it was subjected throughout the eighteenth century [Aguilar Camacho, Granado Castro, Lozano Martínez 2020], we have used the preceding military cartographies –done during the works– and later –concluded these–, yielding a result of maximum precision, especially with the last plan of 1798, which is a symptom of the exactitude of the model (fig. 7).

It should also be noted that Ximénez not only recorded the buildings in their current state, but also studied the projects and plans of the buildings that were being executed in the city, in order to reproduce the appearance

that they would have once the works were completed. An example of this is the new Cathedral of Cadiz, which was under construction and whose original project had been replaced in 1775 by another that modified the facade, the towers and the dome that were being built [Navascues Palacio 1982; Marías Franco 2007]. In this sense, the model contributes to know what the cathedral would have looked like if this project had been executed, constituting a unique three-dimensional vision of this ephemeral proposal (fig. 8), since it was replaced by a more modest one in 1790.

In addition to this, the model has a significant group of buildings that are completely modeled inside, detailing the composition of their rooms, patios, walls, and arcades, as well as auxiliary elements such as stairs, pavements, etc., which could be observed by uncovering the roofs or extracting them from the model. These are civil and military buildings that belonged to the State –customs house, barracks, engineers’ pavilion, etc. [Garófano Sánchez

2022] – that Ximénez reproduced in order to create a holistic representation of the architectural structure that was at the service of the Government.

In short, the ambitious project undertaken by Ximénez not only faced the difficult task of making a 1:250 scale urban model, but did so with great rigor and accuracy, expanding the objectives of the same; and, ultimately, developing an ideal prototype for the government of a stronghold.

Materiality, abstraction and sumptuousness

As a whole, and in general, the model of Cadiz is made with only three types of materials –wood, ivory and silver– which were carefully selected and acquired by Ximénez during the process of study and execution in the city of Cadiz. In this sense, the author of the model requested samples of the different types of wood existing in Spain –including those from its overseas territories– and even from China, in order to determine their material qualities and their combinatory capacity [Martínez Montiel 1999].

The support is made up of 39 wooden boards that support the entire surface of the model. On top of these, there is a set of cedar panels carved in an undulating form that reproduces the sea that surrounds the city, and a framework of slats gives shape to the topography on which it sits; all of which is hidden from the viewer when the model is assembled.

The final result is dominated by the use of wood, which represents the entire land surface emerging from the ocean, as well as all the fortifications, streets and squares, and buildings that make it up. Specifically, there are numerous types of wood used in the model –mahogany, ebony, cedar, boxwood, acacia, guava, rosewood, orange, cherry, pine, etc.– [12] selected to fulfill a specific function in the model according to their nobility and hardness (fig. 9). For example, the lighter shades are arranged on the facades and in some of the city’s public spaces, while the roofs are darker to offer a slight contrast with the support. Some of the most important religious buildings in the city have a delicate tonal nuance through the use of cherry, which allows them to be more easily identified. Finally, the black notes obtained with ebony are located in the window frames and balconies of the buildings. This combination of materials offers, through subtle chromatic differences, the possibility of differentiating and identifying

Fig. 10. Representation of the Cathedral in the model of Cadiz (Museo de las Cortes de Cádiz) with respect to the current reality. Photo by the authors.

Fig. 11. Detail of the meticulous work on the Castles of San Sebastián (top) and Santa Catalina (bottom) surrounded by ocean in the model of Cadiz (Museo de las Cortes de Cádiz). Photo by the authors.



the several depths of the plan-relief, to the detriment of a realistic representation of the materials.

The model is made up of about 350 detachable pieces that fit on the support structure and conform the buildings and military installations of the city. The blocks made up of several houses belonging to the hamlet are assembled to form a unit that facilitates assembly but which, in turn, allows the identification of the buildings that compose it through the courtyards and the parapets that make up the roofs through the crowning of its internal walls. The facades of the buildings are only represented in detail – doors, balconies, cornices, etc. – in those places where they can be observed and have an important role in the urban scenography of the city. That is, those facades facing the sea or the main squares of Cadiz, leaving the rest of the facades undetailed beyond their profile.

Ivory is reserved for the crowning of the great defensive elements – bastions, ravelins, castles, etc., as well as the numerous sentry boxes that dot the walls – which makes it easy to identify by contrast with the wood the location of the main lines of defense and lookout elements; and all of this, without there being a material relationship with the tectonic reality. Likewise, this material in combination with bone is used for the representation of the city gates with the same purpose although, in this case, two of them were made of white marble, showing a possible material or tonal analogy. A similar case is the representation of the Cathedral that, with resounding clarity, seeks the synthetic translation of the material duality that in effect this building possesses (fig. 10).

The solid silver formed by fine plates worked by a goldsmith silversmith of the city was spread over the undulating wooden support that forms the ocean [13]. Unfortunately, the disappearance of this material prevents us from understanding the impact that the brilliance and shine that this extensive silver surface would cause in any observer. In a recent restoration, it was decided to recover the appearance with silver leaf, which, although it resembles the primitive materiality, does not have the reflective capacity and purity of silver.

Finally, Ximénez also went so far as to design the figuration of the model by, for example, the making of 500 cannons that he placed in the loopholes of the walls and more than 200 ships to scale along the great mass of oceanic silver [14]. Likewise, the author conceived the model as a scenographical artifact that would allow the entertainment of royalty, for which he orchestrated a specific



Fig. 12. Model of the Church of the Holy Sepulchre, Jerusalem. It is possible to disassemble it to access the interior where there are other parts. Finch & Co Gallery. Photo by the authors.

assembly that would include an explanatory book, a stairway to observe the model from an elevated point of view, binoculars to observe all the details from a distance, large banners and damask fabrics that hid the internal structure of the support [15].

The use of only three materials gives the model a very high degree of abstraction (fig. 11) and distances it from the models of fortifications and fortresses that were being made in Europe at the time, characterized by their realistic representation of their finishes and landscapes. Moreover, the model omits the landscape and vegetal qualities of the context, in order to distance itself from any material simile with reality

—with the exception of the Cathedral—. In this case, the exercise of synthesis proposed by Ximénez confers another type of plastic and atmospheric qualities far removed from figuration and which are articulated through the different and rich tonalities of the wood, the delicate details of the ivory carvings, as well as the intense brightness projected by the great mantle of solid silver that surrounded the city. All of this gives it a unique character that moves away from traditional representations and is closer to the qualities of the most refined decorative arts of the time — even due to the training of its executors— and, specifically, to the furniture qualities of the objects acquired by the Spanish monarchy for the decoration of its architecture [Sanchez Casado 2021; López Castán 2005]. Likewise, we can relate the sumptuary character assumed by the model with other architectural representations to scale that, in this case, were created as objects of worship and veneration, and for which noble materials were used — mainly olive wood, mother-of-pearl and bone—, specifically highlighting the richness and fineness of their carving. We refer, for example, to the models of the Holy Sepulcher in Jerusalem that were made in this city during the 17th and 18th centuries for commercialization and export as a souvenir and testimony of this sacred space (fig. 12) [Williams et al. 2014].

Conclusions

Throughout this article, it has been shown how the model of Cadiz constitutes a unique and exceptional sample of graphic representation in the ideation of a scalar prototype to serve as an instrument of integral and accessible understanding for the government of a city. An ambitious proposal that made possible and facilitated immediate access to the

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Notes

[1] AGS (Archivo General de Simancas), SGU (Secretaría de Guerra), File 3807, Sheet 577.

[2] “It would be very useful to have in the Secretary’s Office of Your

conditions of a stronghold and, specifically, to the morphology of the defensive infrastructures, as well as to the civil and military buildings that were at the service of the State; all of which offered an enormously useful three-dimensional support for reflection. However, the scale chosen by Ximénez, who specifically preferred to increase the size of the model due to the difficulty of capturing his project at a smaller size —“an imponderable work due to the smallness of its parts”— [16], configured a prototype of disproportionate dimensions and difficult to handle, both for its size and its weight; all of which, added to its high cost, would lead to the halt of the Fortification Cabinet project.

The elements that through the 3D survey of the model we have been able to compare with reality or with contemporary cartography have revealed a great fidelity and precision in the survey and formalization of it, specifically regarding the defensive infrastructures. Likewise, and from the perspective of graphic expression, this prototype represents an advance with respect to the cartographies of the time by incorporating, for example, the morphological representation of the buildings that made up the city’s hamlet, whose courtyards and internal walls are represented on the roofs of the blocks, thus facilitating a comprehensive understanding of the city; even anticipating the projects that were being developed at the same time as the model.

Finally, it should be noted that the model was conceived as an artistic and ornamental object that was to occupy a dominant place in the palace rooms —“the quality of the model will in no way detract from the decency and security of the site”— [17], as indeed came to be the case, and for which sumptuous materials typical of the discipline of the decorative arts were used. In short, we find ourselves before a prototype model that, added to the rigor of architecture, brings new concepts and approaches to the field of graphic and artistic expression of the time.

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Excellency the Strongholds of the Kingdom worked in models of competent magnitude and exact measurements, not only for Your Excellency’s government and prompt knowledge of any additions or repairs that may be projected or agreed to be made in any of them, but so that Your Maje-

sty, the Prince and Infantes, at all times, could understand with effective property the fortifications of each Strongholds and the defense of which it is capable". *Ibid.*, Sheets 32-36.

[3] *Ibid.*

[4] *Ibid.*

[5] AGP (Archivo General de Palacio), Box 804, Exp. 2, Sheet 48.

[6] AGS, SGU, File 3807, Sheet 577.

[7] *Ibid.*, Economic report (June 16, 1779).

[8] *Ibid.*, Sheet 618.

[9] AGP Box 804, Exp. 3 and 18.

[10] AGS, SGU, File 3807, Sheet 145.

[11] The scanner model used is Leica BLK 360 and Cyclone Register processing software. During the survey, the main problems arose from

the lack of space to locate the scanner, as the architecture around the model is very narrow. Also, the existence of a protective mesh in the upper gallery makes it impossible to take scans from elevated points, which would help considerably in capturing the interior of the different streets that make up the model, the main problem in this particular case. Therefore, during the survey campaign, different solutions were devised to locate the scanner at elevated points, by placing ephemeral elements to support it. In total, 8 scanning stations were set up, 4 on each side.

[12] AGS, SGU, File 3807. Record of October 1777 and September 1779.

[13] *Ibid.* Receipt for the work of the silversmith Antonio Lozano on the model.

[14] *Ibid.* Expenditure notes (May 1, 1779, and October 13, 1779).

[15] *Ibid.*

[16] *Ibid.* Record of September 1779.

[17] *Ibid.* Letter of May 5, 1779.

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