

INTRODUCTION

The use of scale models for the three-dimensional visualisation of a new design has been standard worldwide practice in construction throughout history. Whereas in architecture any number of examples of such models have survived and been generously studied from ancient to recent times, the models and mock-ups for historical works of engineering have suffered a different fate. Their want of study and low survival rate have created an unmerited historiographic void and bred intellectual contempt for what is ostensibly the tangible evidence of science-supported material progress. Taking the better known history of architectural models as its baseline, this exhibition displays, for the first time, a group of the Crown Heritage's scale models of absolutely exceptional beauty and perfection. The intention is to highlight the beauty of Greek and Roman temples inherited from the classical world as an initial reference before turning to the seductive universe of engineering and construction, a cosmos in tension where the forces in play, like proportion in the classical orders, while not immediately in view, are known by all to lie therein.

Further to the objectives that define Fundación Juanelo Turriano's mission, this exhibition focuses on the documentary value and scope of a heritage that we have been unable or unwilling to conserve. Despite the material value and beauty of these creations, they have been routinely disdained or at best regarded as little more than curiosities for collectors, museum pieces, simple decoration, mere form empty of any actual content. In our opinion, in contrast, these historic models are splendid documents that clearly state what the graphic and written record often silences or never acknowledged. Each of these models and mock-ups is backed by a history of its own that links it to the built work, such as the La Carraca dry dock at Cadiz [cat. 15] or Torres Quevedo's aero car over Niagara Falls [cat. 32]. In addition, however, at times they were devised to test the behaviour of the component parts of works under construction: the model for the structure supporting the roof over the parquet in Madrid's Royal Theatre [cat. 30], for instance, that sparked heated controversy among contemporary professionals. In other words, these are live models. Some served as testimony in administrative proceedings, such as the eighteenth century model of Alcántara Bridge [cat. 2] brought before the Council of Castile as evidence of its damaged structure. A nineteenth century version of the same bridge, located in the Spanish province of Cáceres, offered a fleeting but real solution to repair one of its arches. The aim, then, was not to represent the bridge as a prodigy of Roman engineering, but rather in both cases to solve the problem posed by its hazardous condition to ensure its continued safe use. That is, indeed, the definition of a live model: one that invents or solves, one that makes everyday life and work easier.

These models are valuable less for the works they represent -in one group, bridges of all kinds: masonry, iron, rigid frame or suspension- than for why they represent them. And on occasion, such as in Perronet's Neuilly Bridge over the River Seine at Paris [cat. 6], which is no longer standing, the model on display acquires even greater significance. In addition to explaining the historical-structural interest of such models, we have determined to unearth the life throbbing under their silent surface by drawing attention to certain details. Thus, for instance, the anonymous author of the Neuilly Bridge mock-up, in the employ of the Spanish Army Corps of Engineers' excellent scale model works, left us a clear record of building times by representing the bridge in various stages of its construction. Models that depict time, live models. Be it said, in a hushed voice, that no other models like the ones shown here of Neuilly or of two other French bridges, Saint-Sever suspension bridge over the Seine at Rouen [cat. 8] and Vergniais Bridge over the River Lignon [cat. 7], are to be found in their country of origin.

While these pages of the history of construction have long been turned, they can be gratefully re-read after the meticulous restoration, funded by Fundación Juanelo Turriano, of many of these pieces. How to do justice here to the designs for huge bridges meant for far away lands that once formed part of our common history, public works authored by our excellent military engineers?

One singular example is the bridge over the River Pasig at Manila. Although it was never erected, the memory evoked by its scale model [cat. 9] stands as living proof that it was envisioned to overcome one of the major obstacles to communication between the Philippine capital and its outskirts. In another, closer vein, the 'Buda' steel lighthouse at Tortosa Cape [cat. 17] seems to have been taken out of a Jules Verne novel, prompting reflection on the what the keeper's life must have been like. Live models. Not to mention the Canal de Isabel II water tower and one of the aqueducts that carried water to Madrid [cat. 14 and cat. 13], *Aqua fons vitae*.

The brevity of this introduction precludes any attempt to reference each and every one of the scale models and mock-ups exhibited: cranes, mineral unloaders, mines, furnaces... The reader's attention is nonetheless directed to a short series of 'ingenious devices' on display. One, the scale model for the coin minting equipment at the Royal Mint Museum in Segovia [cat. 23], was used as a blueprint to build a new water wheel-driven device with Fundación Juanelo Turriano funding that can be seen in operation in situ. Another depicts the device used to saw wood at the arsenal at Havana, Cuba [cat. 21]. And last but, for us, by no means least, the artifice authored by Juanelo Turriano to raise water from the River Tagus to the royal palace/castle at Toledo has been minutely re-interpreted in the scale model on display here [cat. 22]. The exhibition also includes two mock-ups of unquestionable value as witnesses of historic city planning. The first, of which Asturians will be especially fond, is the restored topographic model of the city and port of Gijón, with its bastioned walls and meticulous description of the city inside them [cat. 18]. The second will be appreciated by Madrilenians especially, with its baring of the innards of the city's 'Puerta del Sol', ripped apart to build the three first underground lines that criss-cross underneath, metaphorically reasserting the square's status as the hub of central Madrid [cat. 33].

As may be inferred from the foregoing, this selection of works does not cover the vast field of scale models in general, for here the focus is essentially on those most closely related to engineering and construction, albeit without disregard for the machines and inventions so dear to engineers. That limitation obviates any attempt to include naval, railway or aeronautical models that form part of other equally exciting ventures. Fundación Juanelo Turriano will feel gratified if this exhibition encourages young researchers to locate and study in earnest the documentary treasure to be found in historic scale models, a thrilling field of research which, despite its difficulties, guarantees the success of their endeavour.

Most of the mock-ups on display, which at the time of their inception were teaching materials used by a given academic department or formed part of institutional library collections, have either never before been exhibited publicly, or only displayed in showings severely limited in time and place. Others, the minority, belong to major museums, some kept in storerooms and others on permanent display but not always surrounded by similar pieces or afforded the generous space or type of company possible here. The random sum of images, forms and materials comprising this ephemeral collection exhibited in the halls of the Centro Conde Duque evokes in us the sensations felt by travellers visiting nineteenth century World's Fairs, where every participating country vaunted its advances in industry, agriculture, trade and civil works in the hundreds of scale models on display in each new edition. When engineer Lucio del Valle visited the Paris World's Fair in 1855, he wrote the following (without our urging to provide us with a closing sentence for this introduction): 'When viewing the countless objects and models on display in this vast fair, showing or representing the most outstanding useful works either concluded in the last few years, presently underway or on the drawing board, one can hardly doubt that the world is heading for imminent, complete and radical change in material well-being and most social relations.'

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