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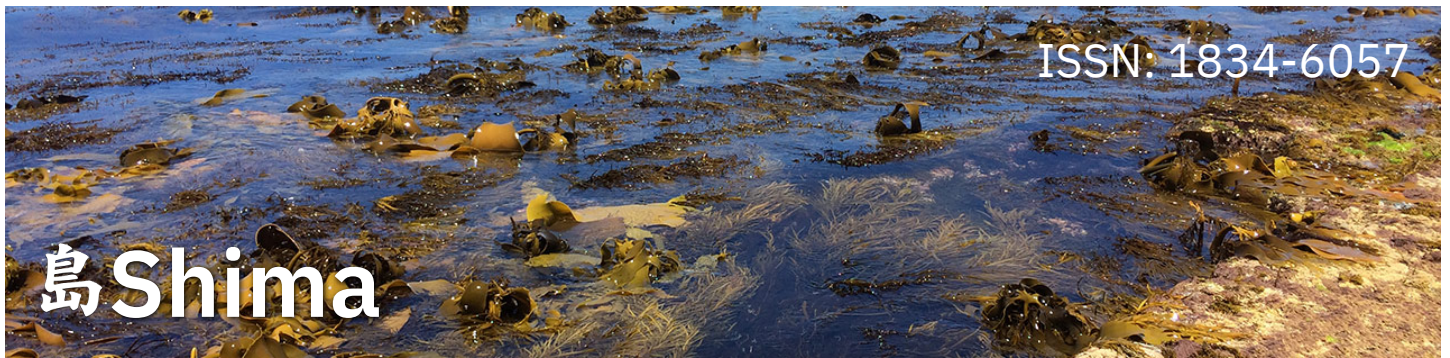
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Article

Fantastic Marine Creatures From the Late Renaissance: Pietro Tacca's fountains in Florence's Piazza della Santissima Annunziata

Giorgio Verdiani, Paolo Formaglini and Filippo Giansanti

Abstract

In the 1550s Florence's water supply was upgraded through the construction of a new aqueduct. Prior to that, water needs were supported by the remnants of a Roman aqueduct and by wells and cisterns. The new infrastructure increased the amount of available water and allowed for the construction of fountains in the city's main squares, with themes principally derived from Greek and Roman mythologies. In 1641 the twin Mostri Marini ('Marine Monsters') fountains designed by Pietro Tacca were installed in the Piazza della Santissima Annunziata. The bronze and stone statues presented fantasy creatures whose flexuous shapes suggested moving fluid. But while these statues complemented the square, they were not originally planned for the location, having been intended for placement in the main Tuscan harbour town of Livorno. This study draws on high-resolution photogrammetry to analyse the structures with this specific digital survey being presented for the first time.

Keywords

Marine monster statues Florence photogrammetry digital survey
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FANTASTIC MARINE CREATURES FROM THE LATE RENAISSANCE:

Pietro Tacca's fountains in Florence's Piazza della Santissima Annunziata

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ABSTRACT: In the 1550s Florence's water supply was upgraded through the construction of a new aqueduct. Prior to that, water needs were supported by the remnants of a Roman aqueduct and by wells and cisterns. The new infrastructure increased the amount of available water and allowed for the construction of fountains in the city's main squares, with themes principally derived from Greek and Roman mythologies. In 1641 the twin Mostri Marini ('Marine Monsters') fountains designed by Pietro Tacca were installed in the Piazza della Santissima Annunziata. The bronze and stone statues presented fantasy creatures whose flexuous shapes suggested moving fluid. But while these statues complemented the square, they were not originally planned for the location, having been intended for placement in the main Tuscan harbour town of Livorno. This study draws on high-resolution photogrammetry to analyse the structures with this specific digital survey being presented for the first time.

KEYWORDS: Marine monster statues, Florence, photogrammetry, digital survey, urban landscape

Introduction

Florence, the main town of Tuscany, has never had an abundance of water and there are a limited number of fountains. While the town grew along the banks of the river Arno, this was not enough to give the area the richness of water available to other cities (such as Rome) where the presence of fountains and waterways is highly visible. Indeed, the Arno represented as much a threat as a resource, with periodic floods remaining uncontrolled for centuries, and the one that happened in 1557 is considered to be the most extreme to date, causing serious damage in many Florentine neighbourhoods (Galloway et al., 2017, pp. 112–113). Throughout the medieval period, Florence kept using the remnant Roman water system, supplementing it with wells and cisterns. This situation of poor water availability continued until the Renaissance when the Medici family started a water renewal program connected to the construction of the new aqueduct in 1551. This can be considered as a part of the second phase of interventions in Tuscany under the Cosimo de Medici's guidance, which was mostly oriented to the creation of new civil infrastructures and urban renewals (Ferretti, 2015).

In a complex series of urban restructuring and upgrading initiatives, the management and control of water had a double function and value. One aspect was practical and operative: bringing fresh and better-quality water to the city, improving the health of the population and enhancing overall quality of life. The second was cultural, symbolic, and political. The city's administration, similar to the Romans before, controlled the innovation of the water supply, modernising and upgrading Florence and moving it beyond the urban context of the Middle Ages. The new infrastructure facilitated a plentiful supply of water and ushered in a new phase for the area around Palazzo Vecchio (the centre of governance) with Bartolomeo Ammannati's Fontana del Nettuno ('Fountain of Neptune', also referred to 'Biancone's Fountain') and other fountains establishing the presence of water in the city's main squares. The new relationship between the city and its water is depicted in Stefano Bonsignori's 1584 map 'Nova pulcherrimae civitatis Florentiae topographia accuratissime delineata' ('A new topography of the most beautiful city of Florence, most accurately drawn'),¹ which represents the water system, both from the river, accurately represented in all its important points across the town, and from the urban water system, with specific attention to each fountain (Else, 2009). This transformation proceeded unevenly, with successive administrations varying degrees of enthusiasm about innovating.



Figure 1 - Views of the Piazza Santissima Annunziata, the fountains, the other monuments and details from the eastern fountain.

¹ <https://curiosity.lib.harvard.edu/scanned-maps/catalog/44-990105955690203941>

Many urban interventions utilised motifs derived from Greek and Roman mythologies involving Neptune, the ocean, and the allegorical representation of important rivers, with many fantastic creatures appearing around the town until the mid-1600s when the twin Mostri Marini ('Marine Monster') fountains by Pietro Tacca were installed in the Piazza della Santissima Annunziata (henceforth referred to as the Piazza SSA) in 1641, just one year after the death of the artist (Figures 1 and 2). While the fountains were placed far from the sea, they expressed an artistic curiosity and sense of wonder about the natural – and particularly marine – world. The matching statues present fantasy creatures whose flexuous shapes suggested moving fluids. While they complement the square, they were not originally intended to be there, having been commissioned for placement in the main Tuscan harbour of Livorno (complementing Tacca's other work there), as part of a renovation plan driven by Cosimo de Medici that involved new fortifications and the further development of the port as a trading centre (Tazzara, 2017).



Figure 2 - Close views and details of the eastern fountain in Piazza Santissima Annunziata, Florence.

Tacca's fountains: A brief history

The history of the Mostri Marini fountains began in 1626, when Ferdinando II de Medici, Grand Duke of Tuscany, commissioned them from Pietro Tacca, a sculptor born in Carrara in the northern part of Tuscany in 1576. At the time of the commission, Tacca had

consolidated his professional activity in Florence, where he started working when just fifteen years old. In his professional life he produced a number of complex statues, developing his skills in the creation of bronzes, with numerous works realised in Italy and a final important work, a statue of the King Philip IV of Spain, being installed in Madrid in 1640 (Torriti, 1984, pp. 39-44).

One of Tacca's most striking works is the Monumento dei Quattro Mori ('Monument of the four Moors') in Livorno, installed at the base of a statue of Duke Ferdinando I, located in Livorno's main square (Figure 3). During Ferdinando I's rule, piracy – mostly undertaken by corsairs based in North Africa, the Ottoman Empire and Middle East (Falletto, 2007) – was rife in the Mediterranean and towers and fortresses were erected as coastal defences and pirates were fought at sea, with victories celebrated and inscribed in official propaganda. In 1621, Ferdinando II commissioned Pietro Tacca to create the models and lost wax bronze castings of four chained Moorish-looking prisoners to be added to the base of the statue of Ferdinando I commissioned by him in 1595 from the sculptor Giovanni Bandini, but which had not been completed. Bandini's work was constructed from Carrara marble and installed in 1601 in an area now included within Piazza Giuseppe Micheli. Tacca's sculpture represented the victory of the Tuscan military Order of Saint Stephen over the so-called 'Barbary pirates' (see Ciapelli, 2017). The four massive figures, with their dramatic poses, were so striking that the monument is more often known for (and named after) their image – as the Monumento dei Quattro Mori ('Monument of the four Moors') – than the Duke whose statue they surround. The meaning of this monument, and the strength in the pose and dynamic expressions of the four prisoners in particular, later stimulated an extended debate about slavery, racism, and violation of human rights, starting from 1799, with the strong opinion of Sextius Alexandre Francois Miollis, commander of the Napoleonic troops arriving in Livorno, who referred to the statue as "a monument to tyranny, insulting humanity" (Rosen, 2009).



Figure 3 - The statue dedicated to Ferdinando I de Medici and the accompanying four Moors in Livorno.

Seen in the context of cultural and artistic values that have been well defined and explored in previous studies (e.g., Carofano, 2009), Tacca's sculpture should be considered with regard to the conflict with the pirates that was an ever-present threat to the people living

and working along the coasts at that time. While the threat of piracy diminished in the years after Miolli's visit, it persisted until the late 1700s, with notable events such as the kidnapping of about 800 inhabitants from Carloforte, Sardinia, who were transported to Tunis and sold as slaves in 1798 (Pellerano, 2010). Tacca's Mostri Marini fountains were intended to be installed close to the Quattro Mori, and may have attenuated the bold presence of the four prisoners by the presence of the water jets from the two fountains and the flexuous shapes of the sea creatures, but the re-assignment of the fountains to Florence isolated the main monument and once the dramatic events that inspired its creation faded away, it communicates most strongly a sense of vertical arrogance.

As Lo Vullo (1931) has documented, a letter dated 6th October 1627 from Superintendent Leonardo Guidotti reports that the overall cost estimated by Tacca for the construction of the two fountains was expensive at 5252 *scudi*,² which is roughly equivalent to one million Euros in current value.³ Having been approved by the Grand Duke, Tacca, with the contribution of Bernardino Radi and the help of his pupils Bartolomeo Salvini and Francesco Maria Bandini, started working on the models for the fountains in 1627 (Cresti, 1982, pp. 56–61). Their individual contributions resulted in an extremely rich composition, mixing fantastic and real elements, and where the main authorship and guidance of the project seem undoubtedly by Tacca, who signed the fountains on the cymatium, just over one of the brackets supporting the two main pools. The intended positioning of the fountains at the sides of the Quattro Mori monument was not only decorative; the fountains were also intended to be used to supply water to the galleys docking in that harbour, so the water jets in the top part were combined with lower spouts serving that function. But, at the early design stage, a radical change in the intended location occurred. In his *Notizie de' Professori di Disegno da Cimabue in qua* (1681), Filippo Baldinucci identifies that Andrea Arrighetti, superintendent of Florentine fortresses and factories in the period, expressed his strong opposition to the installation of the fountains in their intended location. In terms of functionality – Arrighetti's main concern – it is plausible to believe that the two fountains, with their minimal jets of water and also their positions, were completely unsuitable to allow the sailors to load the large barrels of the ships in acceptable times and also took up too much space on the dock compared to the service they would offer. The effect of Arrighetti's intervention was definitive and the fountains never reached Livorno and were replaced by more standard functional fountains, as can be seen on the right side of the monument of the Quattro Mori in the engraving of the Port of Livorno by Stefano della Bella dated 1655.⁴

At this point, the Grand Duke Ferdinando II decided to move the two fountains to the Piazza SSA in Florence, where they were inaugurated on June 15, 1641, just one year after the death of Pietro Tacca, whose tomb was close by in the Church of Santissima Annunziata (Settimanni, 1875). In aesthetic terms, the commonly acknowledged great beauty of Piazza SSA was complemented by the two fountains. The two large bronzes with their wide steps and pools were placed in a square rich in high quality artworks. These include Filippo Brunelleschi's porch for the Spedale degli Innocenti (built in 1417–1436) which is recognised as one of the masterpieces from the Renaissance, the entrance to the Santissima Annunziata Church on the large corner of the Budini-Gattai Palace (former

² The *Scudo* – plural: *scudi* – was the name for a number of coins used around Italy until the 19th century.

³ A calculation based on the value of present gold in reference to one *Scudo* from the 17th century, with a weight up to 4.4 grams (Marsuzi, 1829, pp. 35–36).

⁴ Online at <https://www.metmuseum.org/art/collection/search/377478>

Griffoni Palace, 1563–1574), and the equestrian monument of Ferdinando I by Giambologna and Pietro Tacca (1608). These provide direction to the square and the emerging massive presence of the cathedral in the distance, framed by Dei Servi street.⁵ It may be observed that the positioning of the two fountains here has parallels with the original setup conceived for Livorno in that in the Florentine square there is the presence of a tall, quite vertical monument which the two fountains work to balance. In the end, the richness of the final organisation of the square made it a focal public art space, making it representative of the town and bringing the Mostri Marini to the attention of citizens and visitors and, later, tourists. The success of the Mostri Marini was so marked that in the early 20th century various imitative fountains were installed in different places around the world. There are well documented copies in Rome, Washington DC, Minneapolis, and London, for example, all made between 1902 and 1920, all reproducing Tacca's artwork in detail (Ostrow, 2018). In 1964, the Fonderia Artistica Ferdinando Marinelli made a new copy of both statues, with the new reproductions intended for Livorno, to complete their original design brief. However, in the event, the fountains were not placed at the sides of the Ferdinando I statue and the Quattro Mori but in two small squares nearby, along the Via Grande. In Florence, the fountains were serviced in 1988 and in 1996, with the restoration of the original system of water spouts, resulting in all the mouths of the creatures operating once again with a proper water flow (Francini, 1997).

The design of the Mostri Marini fountains

The fountains were designed to be both decorative and functional, presenting plays of water and spouts that could be used to refill a flask or a bucket. This double function is supported by a rich decorative system that presents a series of wondrous and real marine animals. The sculptural environment in which the shapes of these fountains takes place is varied and carefully and articulated. It is possible to define a mix of influences and evocations arising from two main points:

1) Based on research about the fountains' shape, their marine subject and fluid flows, the water is clearly an integral part of the whole design, with the water's dispersal being deliberate, realising the original concept of the structure. This exemplary from an artist on the passage between the Renaissance, Mannerism and the incoming Baroque (Fagiolo Dell'Arco, 1978), confirming how categories in the official phases of art history may be quite fluid. The fountains' cultural references were rich and easily available, with previous artists and architects having taken the design of fountains in Florence towards dynamic shapes that freed them from rigid layouts and moved to flexuous shapes in marble or in bronze. Bartolomeo Ammannati's Fontana del Nettuno ('Neptune's Fountain'; 1550) in Piazza della Signoria, with an articulated series of bronzes (1575) around the central statue, was an early step in this direction. Similar functions and use of subjects can be found in the secondary elements around the Fontana dell'Isola in the Boboli Garden (1637), whose central group was created by Giambologna (Creighton, 1973, pp. 251–253), in whose studio Tacca started his professional career in 1592. Most of these references come from the city where Tacca was operating, but more robust cultural references also came from Rome, where the creation of large and complex fountains was even more visible and monumental, and where some references appear, such as Gian Lorenzo Bernini's Fontana del Tritone ('Triton's

⁵A panoramic VR video (in 8K resolution, time lapse mode) about the present state of the square was realised by the Laboratory eXtended Realities (DIDA-LXR) from the Dipartimento di Architettura, University of Florence, and is available on YouTube: <https://youtu.be/tEdSBYm7Ins>

Fountain'), which was developed at a similar time (1642–1643) (Delli, 1972). This convergence towards fantastic marine subjects is not an accidental one; sculptures from the Roman age often presented marine creatures, and Greek mythology included a wide range of subjects and myths about water deities (Ieranò, 2017, pp. 41–51). But, at the same time, the use of wondrous aquatic themes and figures reflected the increasing scientific interest in and attraction for weird creatures that had been present since the Renaissance (Ghadessi, 2018, pp. 9–40).

2) The fountain designs also suggest a will to manifest knowledge and control over the external world. Tacca's fountains include subjects and elements that are not wholly invented. They draw on a bestiary of sea monsters and wonders, creating a small catalogue of surprising subjects. It is possible to recognise a series of characters in the fountains, with almost all the shapes having a specific identity and with parts of the creatures extending from the main bodies and guiding the articulation that models the artwork.

The twin sea satyrs/devils/tritons, which dominate the top part of the fountains, are positioned opposite each other on their backs, almost completely symmetric in their poses. From their backs, a fish-like pair of fins and tails rises, completing the pose with something halfway between a plant and a fish part. The mix of animal and plant elements predominates in these creatures; the heads show horns and have eyes and mouths that are barely human but, at the same time, recall the head of a large fish. The body has humanoid arms, a quite simple trunk, with an essential characterisation that allows recognition of the male gender of the two creatures and a double long tail in place of the legs. Both the tails (or coils) are twisted in a spiral pattern that rolls the two bodies, and the hands of each statue grip the tails of the other. Both the statues project a spout of water from their mouths, which falls in the basin created by the lower creature. The model of the creature may recall a triton, but is possible to see similar creatures in Ambroise Paré's⁶ book about monsters and marvels – published for the first time in 1573 in France with the title *Des monstres et prodiges* – specifically the 'Marine monster having a human torso' and the 'Hideous figure of a Sea Devil'. About these creatures, Paré (1982, p. 112) writes:

In the year 1523, on the third day of November, this marine monster was seen in Rome, the size of a child of five or six years of age, having a human upper half as far as the navel - except the ears - and the lower [half] similar to a fish.

Gesnerus⁷ mentions this marine monster whose picture he had obtained from a painter who had seen it in its natural setting in Antwerp, having a very savage head, with two horns, and long ears, and all the rest of the body that of a fish, except the arms which approached the normal; which was caught in the Illyrian Sea, throwing himself up on to the shore, trying to capture a small child who was near there, and, being hotly pursued by some sailors who had caught sight of it, it was wounded with blows from stones and shortly afterward came to the water's edge to die.

The references in Paré's book are derived from Conrad Gessner's *Historiae Animalium* (1551–58), which is, in turn, based on categories defined by Aristotele (Kusukawa, 2010). The

⁶ Ambroise Paré (1510–1590), a French surgeon and scientist, author of various books about medicine and surgery and of some essays about nature.

⁷ Conrad Gessner (1516–1565), a Swiss physician and naturalist, author of the *Bibliotheca universalis* (1545–1549) and of the *Historia animalium* (1551–1558).

influence of the volumes by Gessner was extremely strong in time and was an inspiration and reference for various graphic works and books. It is distinctly possible that Gessner directly inspired the design of the main creatures of the fountains.

The double leviathan figure is partway between a large shell and a manta or some kind of whale. Its function is clear, creating a large basin beneath the two central creatures to receive the water spreading from their mouths, while its head is tilted in a way to throw back a spout of water. For this, the whole body of the creature is bent around the central empty space, while the shape of the whole animal is folded to create the border of a small pool. The details, like the face and the skin, all recall the marine nature of the monster, with large, corrugated fins and spikes along the spine. The lower part of the body opens in two tails against the central body of the fountain. Both the tips of the tails open to two nozzles that allow water to flow out. From this point, two other secondary tails develop and embrace each other, while the border of the body transitions into a coil passing around the central part of the fountain. These creatures sample and partly resemble certain marine monsters often represented in maps during the Middle Ages and the Renaissance (Van Duzer, 2014, pp. 71–91), with shapes only partially visible and with the presence of water offering a completion of the creature itself (a typical technique for indicating some dangerous area in the sea, or the presence of large leviathans, like whales and cachalots with their spectacular water spouts). This was a period of great geographical discoveries, global travel and the reporting of distant wonders and there was a need for clear maps to assist mariners and merchants to move across a wider world (Davies, 2016, pp. 47–64).

The lower part of the fountain is crowded with minor presences; two large festoons are placed around the central body, moving between two brackets. These decorations are different on the two sides: on one, the sequence of shells, mostly recognisable for various types of Murex (*Bolinus brandaris*), are centered on a large crab, used as a 'seal' in the centre of the fluid shapes, acting as the reference for a robust symmetry axis. The crab is highly detailed and realistic representation of a (real) crab. Once again, both the crab and the Murex are quite similar to those represented in the Gessner's *Historiae Animalium* (Figure 4). On the other side, by contrast, the sequence of shells is continuous with the introduction of some fish and/or some variations. The two brackets supporting the whole composition are more geometrical and refer to architectural shapes, but this reference is turned into the aspect of one more creature, giving its face to the front part of the spiral element which is modelled to look like a couple of waves framing this minor monster coming out from the water. From its mouth, another spout of water directly enters the basin in the stone basement of the fountain, and two groups of suspended fish connect each bracket to the whole composition.

In general, the whole set of creatures were realistic with regard to the manuals and bestiary of the period and, in several cases, Gessner's and Tacca's creatures are closely similar. At that time, the opportunity to directly encounter a 'sea monster' was extremely rare, with knowledge of such things being primarily based on drawings, paintings, books, and oral descriptions. In its own way, the fountain constitutes a collection of significant wonders from the sea, all structured to form a surprising group, a series of mysterious and even menacing creatures coordinated to offer water to the humanity passing by the fountains.



Figure 4 - Marine Monsters from the Gessner's book. From the top, 'the Marine Satyr', a large fish, the crab and the Murex; the similitudes with the elements in the artwork from Tacca are easily recognisable.

The digital survey of the fountains

Starting from July 2021, a survey of the fountains was undertaken with the intention of creating digital twins of both the statues in Florence and of at least one of the statues in Livorno and to study the elements through digital modelling. The main advantage of this procedure was the possibility of checking the sculpture from any point of view, having an immediate change in perspective, and using the orthographic visualisation to better understand the relationships between parts and the logic of the general design of the statues. The geometric accuracy of the resulting model is extremely high and allows an understanding of the correct overlapping of layout grids, which is useful to understand the logic of the design, the balance of shapes, and the geometric plot behind the artistic choices. No direct examination of the item can be compared to the resulting models coming from this processing in terms of efficiency and, even for the most old-fashioned scholars, these models have the advantage of allowing close range observation, viewpoints from the top, and viewpoints on the higher parts – a special and personal examination that no one may be able to conduct on the real object without staircases or scaffolding and a generous set of authorisations. Once more, the creation of these models has a specific extra value: the possibility of sharing the state of the artwork with other scholars at distance; anyone from anywhere, accessing an online version of the resulting model, may study, analyse and observe the results.

To make a proper digital twin of the fountains, digital photogrammetry based on Structure from Motion/Image Matching (SfM/IM) procedures (see Guidi et al., 2015, pp. 321–324) was clearly preferable. This allowed for the immediate texturing of all the surfaces and the option of variations in the level of details for different parts of the statues. The easy-to-use, professional quality, low-weight camera with and high-quality sensors and lenses can be easily moved to take pictures of any corners and could be hung over the subjects using tripods and poles. The framing of the scene can be controlled using a remote-control app on a smartphone, making this approach very practical and preferable to any other digitalisation device for the aims of the research. There were two possible issues with the materials – the reflectance of the bronze surfaces and the presence of water – but these did not influence the result. The first was reduced and avoided by taking the pictures when the statues were in shadows or by exploiting cloudy days. The second did not cause issues, as the fountains were always found with minimal water in the basins and the active spouts did not cause any influence in the results.



Figure 5 - The copies placed in Livorno and their photogrammetric survey; similar operations were adopted for the original fountains in Florence.



Figure 6 - Phases of the structure from Motion/Image Matching photogrammetry, the various steps between point cloud generation, surface creation, and texturing.

The equipment used for all the photogrammetry work comprised a Nikon D850 camera, with a resolution of 47.3 Megapixels mounted with a Nikkor 16-35mm F4 zoom lens. The choice of this wide-angle zoom was due to its excellent quality, for its extended depth of field, and for an easy framing of the articulated sculptures even for close-range shots. The survey operations for the East fountain covered the bronze statue and its whole base, with all the steps and a part of the surrounding floor; the SfM/IM photogrammetry was then conducted using the Epic Megagames software Reality Capture.⁸ The photogrammetric survey of the West fountain was based on a lighter intervention, focused on the fountain only and on its stone basement.⁹

The topic of the numerous copies of these fountains appealed and access to the copies in Livorno was quite easy and direct, with a specific photogrammetry of one of the two being organised in August 2021 using the same equipment. A simple visual check of the resulting model testifies the extreme correspondence between the copy and the original.¹⁰ However, it is worth stating the Livorno copies look distinctly 'out of place' in their present location, with a very limited environment, defined by recent buildings that have nothing to share with the sinuous shapes of the bronzes. The dry condition of the copies, with all the jets switched off and empty basins, made it extremely easy to conduct the photogrammetry work, although their condition gives an impression of decay and a generally poor aspect to these well-made copies. To put in scale the photogrammetry from the fountains, some direct measurements were taken from the bases, using the stones in the steps as references and using them later to resize the models in Reality Capture. All the models were then simplified to be compliant with online use, keeping attention in preserving a good level of

⁸ The 3D model of the western fountain is available in sketchfab.com at the URL: <https://skfb.ly/oqyv>

⁹ The 3D model of the eastern fountain is available in sketchfab.com at the URL: <https://skfb.ly/oqy79>

¹⁰ The 3D model produced from this photogrammetry is available in sketchfab.com at the URL: <https://skfb.ly/opSro>

detail, and then uploaded in the platform Sketchfab.com where are all available for viewing and inspecting.



Figure 7 – Orthographic views of the digital 3D model of the western fountain in Florence.

Representing the sea monsters

The digital twin of the fountains allows easy access to any point of view of this artwork. All the details can be easily explored, but one of the more interesting features from these models is the possibility to analyse their orthographic representations and better understand, from their frontal, side and top views, how they were dimensioned, designed, and harmonised. It is apparent that even such a work of imagination needs rules. Specific quantities of bronze, of stone and of pipes, and proportions, are needed to enhance and increase the quality of the result. Once more, if it is true that this artwork 'put order' between marine monsters, science and knowledge of its time, this order should be present in geometry and proportions. If the fountains brought these creatures to spout water and work at the service of humanity, even their poses and curves should follow human rules and formulae. Or not. So, a check using this accurate survey was a good occasion to investigate the design behind the fountains.



Figure 8 – Orthographic plan view of the digital 3D model of the eastern fountain in Florence.

There were three premises to our investigation. The first concerns the possible differences between the two fountains – something in the pose of the figures or in the decorative elements. But these are not present; overlapping the orthographic views, it can be seen that there are no significant differences between the two fountains. So, the eastern or the western fountain can be considered essentially the same for checking the geometry of the basic design of these artworks. The second premise is obvious: the need of using a measurement unit compliant with those used at the time Tacca was working. The Braccio Fiorentino ('Florentine Arm') (Chiovelli, 2007, p. 135) is probably the best candidate for

such a context. It is equal to 58.36 centimetres and was widely in use in Tuscany for various professions, from painters to architects to sculptors. The third premise is about the way the fountains were set up; the Florentine square was a late choice for a locale, so trying to align a dimensional grid from the base may be not logical, while the final positioning may have influenced the proportions between the parts in bronze and those made in stone. For this reason, a simple grid in Florentine arms was overlapped to the side view of the fountain, aligning it to the top part and checking the results. The best solution comes out to be the one with the grid aligned to the top crests/coils: in this way, most of the lines from the grid find some correspondence with some elements from the bronzes or from the stone basement. It turns out to be a main design grid based on four-by-four Florentine arms, with the use of fractions (half arm and a quarter of arm) that organise the fountain shapes in a well-balanced way. The sides of the fountains are easily included in this grid, while the plan view, with some tolerances, fits in a grid of four and a half by four Florentine arms. Tracing circles on the grid confirms a generic dimensioning of the central column and of the pools around the measure of one Florentine arm.

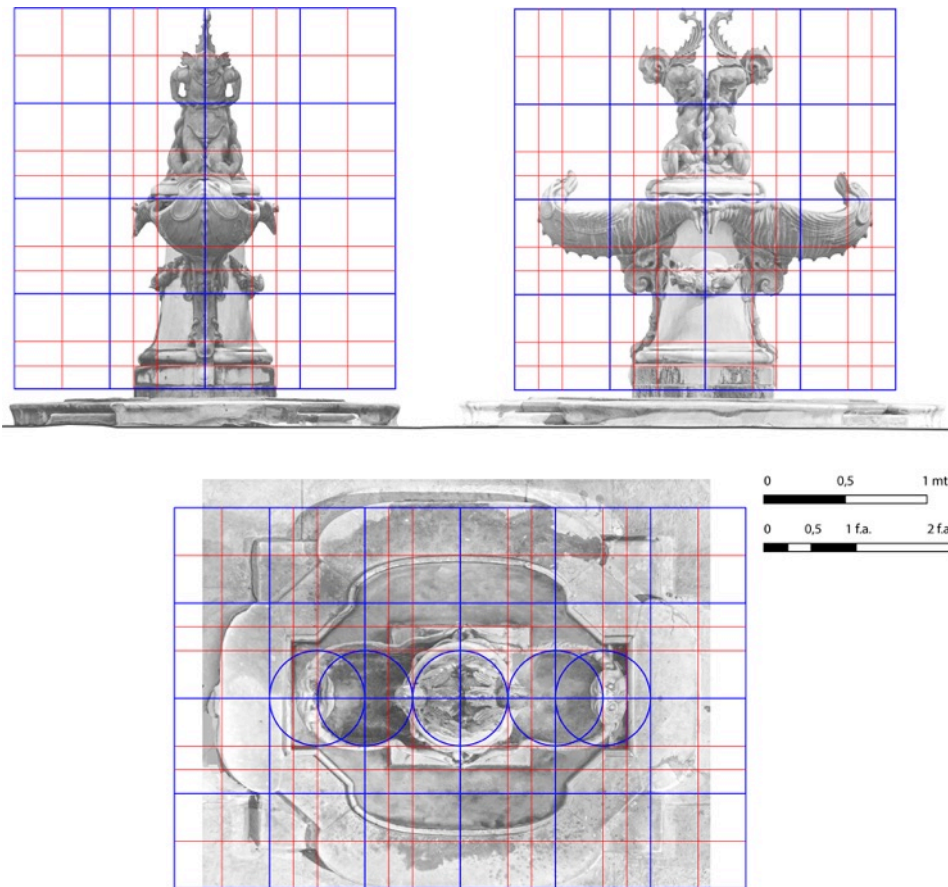


Figure 9 – Orthographic views with the study of the original proportions and dimensions of the fountains.

Conclusion

Marine monsters are the invention of the human mind that creates weird creatures to explain and define what is seen between the waves and appears under the surface of the water or arrives, decayed, on the shore (Centini, 2014, pp. 5–9). But, in the 17th century, the benefits from the cultural evolution that happened during the Renaissance were bringing people far from unshaped reasoning and fears and the creatures of the sea were beginning to be catalogued and, even if barely defined, known, and ‘controlled’. And even if for the most incredible beings the barrier between real and myths was extremely feeble, all of them were available for the design of the statues, with the water creating the opportunity to merge the aspects of the sea with the needs of humanity. The scientific and taxonomic contents of books were available to fascinate and inform artists who could then choose to follow or depart from their examples, bending the fantastic to the procedures of sculpting and casting and to a personal artistic language. The formal and decorative purposes of the fountains provide the occasion for putting together these elements according to geometric rules and allowing for the deployment of unprecedented skills in the realisation of bronze sculptures. The result is an extremely robust and complete process, deriving from enhanced infrastructure, such as the aqueduct, using elements of beauty and surprise like the ‘Marine Monsters’ and bringing them to the service and for the delight of the public. Four centuries later, the creation from this passage between Mannerism and Baroque still communicates the great intentions of connecting the world of imagination, artistry, and technologies. The digital survey and online sharing of the digital twins of the fountains creates a new copy of these monuments and offers, due to the digital approach, a new occasion to re-read the classic, facilitating understanding and sharing the possibility of a dynamic view from any device to the art of the 17th century.

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