



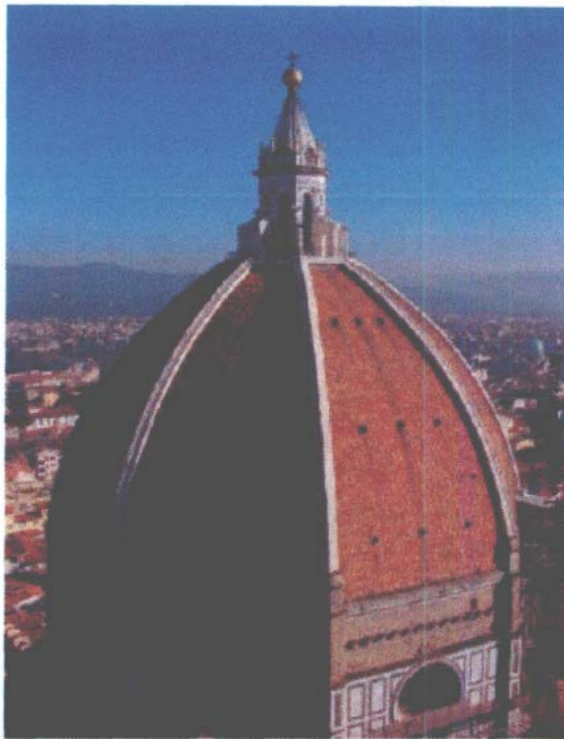
Filippo Brunelleschi and the Creation of Il Duomo

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The Renaissance was a period of great ingenuity characterized in part by a rebirth of Classical antiquity, including the revival of ancient building forms. Many artists participated in the Renaissance and were responsible for bringing Classical features to the forefront of the culture. An artist who made a significant contribution to Renaissance architecture was Filippo Brunelleschi (1377-1446). According to the historian Giacomo Leopardi, “Filippo di Ser Brunellescho, of what it was said that from the time the Roman lords ruled the world until now there never was a man more singular in architecture than he, supreme in geometry and a perfect master of sculpture; and in similar things he had very great ingenuity and imagination, and the ancient building art of the Romans was rediscovered by him.”⁽¹⁾ This essay overviews Brunelleschi’s background, describes the competition that solidified architecture as his choice of career, and discusses the building of one of his most famous projects--the dome for Santa Maria del Fiore, or *Il Duomo*. (fig. 1)



[Picture included from print edition]
Image courtesy of Boris Kester, traveladventures.com

Born in Florence in 1377, Brunelleschi, or Filippo di ser Brunellesco di Lippo Lapi, was the son of Ser Brunellesco di Lippo Lapi, who was a prominent notary in Florence, Italy.⁽²⁾ Brunelleschi showed talent in art early on, but his father did not want his son to become an artist because at the time the profession was not well respected. Despite his misgivings, Ser Brunellesco acknowledged his son’s talent within the art field and apprenticed his son to a goldsmith.⁽³⁾ The extent of Brunelleschi’s artistic genius would soon emerge and the inherent artistic skills that he would continue to develop would become widely respected throughout Florence.

An important event in Brunelleschi’s life is generally credited with encouraging him in the direction of architecture. In 1401, a competition for creating a set of bronze doors for the Baptistery of Santa Maria del Fiore in Florence was announced. Santa Maria del Fiore was very important to the city as it was considered to be its official church and symbol of the city. It also reflected republican ideals related to ancient Rome.⁽⁴⁾ The competition theme was the Biblical story of the sacrifice of Isaac, which also reflected the city of Florence and its own sacrifices. The competitors were required to demonstrate their skills in representing the portrayal of the Biblical theme in a single panel made of bronze.

As the competition narrowed, the judges were divided between two panels, that of Lorenzo Ghiberti (1378-1455) and the other by Filippo Brunelleschi. Lorenzo Ghiberti was a young unknown craftsman who remained as the single challenger to the well-established Brunelleschi. Though both related the same subject matter, the two panels were drastically different. The figures in Brunelleschi's panel were dramatic and the picture plane was relatively flat. The panel was cast in multiple pieces and required a lot of bronze. Ghiberti's panel, on the other hand, exhibited elegant figures and command of three-dimensional perspective. It was technologically more advanced than Brunelleschi's because it was cast in a single piece of bronze. In casting a single piece of bronze it allowed for easier repairs and also did not weigh as much as a panel with multiple pieces of bronze.(5) For these reasons, among others, Ghiberti's panel was chosen as the winner of the competition.

After the defeat for the commission of the bronze doors, Brunelleschi, disillusioned, sought new direction for his creative talent. Brunelleschi and his close friend, Donatello, traveled to Rome in search of fulfilling these ideals. (6) While in Rome, Brunelleschi became intrigued with ancient architecture and the vaulting methods of these buildings in particular. One building especially intrigued Brunelleschi--the Pantheon (118-128 CE).(7)

Originally dedicated to all of the Roman gods and goddesses, the Pantheon was built during the Roman Empire.(8) Still standing today, it has an enormous dome which spans the structure of the building. Because the building was so well preserved from Roman times, Brunelleschi was able to study in person various important technical aspects related to building a dome of such magnitude. Brunelleschi would utilize some of the methods he witnessed in the Pantheon in combination with his own unique solutions in order to create the dome for Santa Maria del Fiore.

One of the obstacles that Brunelleschi noticed the Pantheon surmounted was counteracting the two forces of compression and tension which push and pull on the vault. The stones in the dome put massive amounts of strain downward on the base as well as a thrust outward. Brunelleschi noticed that where the horizontal stress was greatest at the base of the dome, these walls were very thick. As the dome ascended, more lightweight materials were used.(9) This technique was significant in developing a dome that would not crush the base of the structure.

Brunelleschi also studied the Domus Aurea in Rome, which is also known as the Golden House of Nero due to the shape of one of its structures. There was an octagonal room in the Domus Aurea that resembled the shape of Santa Maria del Fiore, where the dome would be placed. This room was covered by a large dome.(10) Thus, the Domus Aurea, in addition to the Pantheon, may also have provided inspiration for Brunelleschi's dome for Santa Maria del Fiore.

While in Rome, Brunelleschi also discovered that the Romans used a building material that became a crucial element for the construction of many of their buildings: concrete. Roman concrete contained mortar that was mixed with volcanic ash which allowed it to be very strong and caused it to be fast setting.(11) With the use of concrete, the Romans were able to build magnificent structures that could bend and curve to the need of the structure. Brunelleschi went on to employ concrete in the dome for Santa Maria del Fiore.

After many years spent away from Florence, Brunelleschi returned in 1418--just in time for the announcement of a second competition relating to Santa Maria del Fiore. (12) On August 19, 1418, it was declared that a commission of 200 florins was to be paid to the person who could provide the best model for a dome over the cathedral of Santa Maria del Fiore.(13) When construction initially began on the building 140 years before, it remained unfinished because it was impossible to use the traditional centering and a system of buttressing to create a dome over such a large span of space.(14) In 1296, its builders were unable to develop techniques to overcome the traditional styles. The construction of such a feat would therefore require a person to use unconventional methods and machines to complete the task.

Santa Maria del Fiore was built to be the symbol of Florence as it would reflect the power and importance of the city for which it stood. The initial plan of the cathedral was to have it be one of the largest in the world.(15) It was only fitting that the dome which would tower over the city reflected the same principles. The responsibility for the funding for the completion of the cathedral and the creation of its dome fell on the Wool Merchant's Guild. The Wool Merchant's Guild was deemed the largest, wealthiest, and most powerful guild in Florence.(16) As the guild neared a decision, two competitors emerged as leaders in the building of the dome--once again, Filippo Brunelleschi and Lorenzo Ghiberti.

Ultimately, Brunelleschi was forced to share the commission with Ghiberti. But the true genius for the construction of *Il Duomo*--as it became popularly known--would become evident and the unrivaled brilliance of Brunelleschi would be known. Although initially awarded joint leadership in the development process, Brunelleschi's model was ultimately the one utilized for the construction.(17) His model demonstrated a process which many believed to be impossible to accomplish; a vault built without centering. Though many were skeptical up until the last brick was

laid, Brunelleschi was able to provide a model that proved it was at least possible.

The advantages to creating a vault “senza armadura”(18) were unable to be overlooked as the cost and labor of building a structure without support would be dramatically lower than that of one with a centering structure. Another valuable aspect of Brunelleschi’s approach was that a large amount of time would be saved by not creating the usual supports. These supports would have to be prepared before the actual building of the dome could begin. They would also have to be created from imported material, which would take time to acquire.(19)

Though Brunelleschi was certain the dome of Santa Maria del Fiore could be built, constructing it still presented several challenges to the architects. Various machines, many of which were developed over the course of the construction of the dome, were created by Brunelleschi to solve the potential obstacles. These included a vaulting and supporting structure, a platform to work on, and ways to lift loads of materials from the ground to the increasing height of the dome.(20) One of the machines Brunelleschi developed that allowed for the transfer of materials to such heights was an ox hoist.(21) The ox hoist had a reversible gear which allowed for a load of materials to be raised and lowered without having to unyoke the oxen to turn them around to lower it.(22) This invention saved considerable time within the building process.

Brunelleschi also introduced the double shell structure design. Brunelleschi was quoted as saying, “Let another cupola be made outside and over the first...that it may be of a greater and more swelling magnificence.”(23) The double shell allowed the outer shell to be relatively thin while the inner shell was denser and heavier.(24) Both shells were simultaneously raised. The quick-drying mortar utilized allowed this process to be accomplished because there was no need to wait for an extensive period of time while the mortar dried.(25)

The eventual shape of the dome of Santa Maria del Fiore was more pointed, or Gothic, than a Roman dome.(26) Brunelleschi made this decision stating, “I have made up my mind to build this vault internally in sections corresponding to the sides, and to give it the form of the pointed arch...”(27) In regards to proportion, a more conical dome allows it to be higher than one of an equal width. It also structurally creates less thrust than a rounded dome because the horizontal thrust changes inversely with its height and the Gothic style is able to be built higher.(28) Compared to the cupola of St. Peter’s in Rome built later from 1585-1590, Santa Maria del Fiore’s dome structure is more pointed. Michelangelo, who designed the dome for St. Peter’s, admired the dome that Brunelleschi built: “It would be difficult to equal...impossible to surpass. I shall build its sister, bigger perhaps but not more beautiful.”(29)

Another key trait that Brunelleschi included in his design for the cupola of Santa Maria del Fiore was the herringbone design of the bricks. Reflecting Middle Eastern style(30) the herringbone bond was essential to the structure of the dome.(31) By utilizing this pattern, Brunelleschi was able to create a structure that did not require the centering support. In the scholar Howard Saalman’s words, “...the herringbone bond would have made it possible to proceed without such support.”(32) In the herringbone pattern, bricks were laid at a horizontal angle while large bricks were placed at a right angle. These bricks rose diagonally to form a zigzag pattern and a strong bond between the bricks.(33) By placing bricks in this type of manner, it prevented the natural tendency for the bricks to fall away from the structure. This also eliminated the need for a support system while the bricks were placed and the mortar set and dried.(34)

As the dome continued its progress, several allegations against Brunelleschi’s plans were directed from Giovanni di Gherardo da Prato. One of the allegations was that there would not be enough light within the cathedral because of the lack of windows within the structure of the dome.(35) Brunelleschi dismissed this opinion because he understood that with many windows, there would be added stress created on the dome shell. The other allegation was that the structure was not being built with the correct ‘quinto acuto’, or the acute fifth.(36) This concept dealt with the calculation of the curvature of the dome and how when calculated, a normal dome’s center height was much lower than the dome that was to be built for Santa Maria del Fiore. The quinto acuto calculates a much higher point in which the structure joins together.(37) Confident that his structural plans for the dome were sound, Brunelleschi dismissed this claim as well.

Il Duomo was finally completed after sixteen years of construction.(38) The final stone was laid on August 30, 1436(39) and the cathedral was consecrated by Pope Eugenius IV.(40) Though the *Duomo* was finished, work on its lantern had just begun before Brunelleschi died on April 14, 1446.(41) Brunelleschi was laid to rest in the cathedral with an inscribed stone, “Corpus Magni Ingenii Viri Philippi Brunelleschi Florentini,” which translates as “Here lies the body of the great ingenious man Filippo Brunelleschi of Florence.”(42) Besides receiving the great honor of being laid to rest in the cathedral, a death mask was made of his face, an honor usually reserved for popes and princes.(43)

Within his lifetime, Filippo Brunelleschi acquired great skills to master techniques of the architecture

of Classical antiquity. He utilized many of these techniques to create one of the greatest architectural feats of his era. In completing *Il Duomo*, Filippo Brunelleschi epitomized the Renaissance and cemented his legacy among the greatest architects.

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Figure 1. Filippo Brunelleschi, Il Duomo, Florence Cathedral, Florence, Italy (1420-1436). (Image courtesy of www.traveladventures.org.)

(1) Quoted by Giovanni Rucellai in the book Brunelleschi in Perspective, Isabelle Hyman, ed., Brunelleschi in Perspective (Englewood Cliff, New Jersey: Prentice-Hall, Inc., 1974), 5.

(2) Paul Robert Walker, The Feud That Sparked the Renaissance: How Brunelleschi and Ghiberti Changed the Art World (New York: Harper Collins Publishers, 2002), 4.

(3) Ross King, Brunelleschi's Dome: How a Renaissance Genius Reinvented Architecture (New York: Walker and Company, 2000), 12.

(4) Walker, 15-16.

(5) Ibid., 21.

(6) King, 24.

(7) J.C. Wood-Brown, The Builders of Florence (New York: E.P. Dutton and Company, 1907), 300.

(8) King, 27.

(9) Ibid., 27-29.

(10) Ibid.

(11) Ibid., 26.

- (12) Ibid., 12.
- (13) Ibid., 1.
- (14) Richard G. Tansey and Fred S. Kleiner, eds. Gardner's Art Through the Ages (London: Harcourt Brace College Publishers, 1996), 690.
- (15) King, 2-3.
- (16) Ibid., 6.
- (17) Howard Saalman, Filippo Brunelleschi: The Cupola of Santa Maria del Fiore (London: A. Zwemmer Ltd., 1980), 96.
- (18) Ibid.
- (19) Ibid.
- (20) Ibid.
- (21) King, 57.
- (22) Ibid., 60.
- (23) Wood-Brown, 304.
- (24) Rowland Mainstone, "Brunelleschi's Dome," The Architectural Review (1977), 165
- (25) Ibid.
- (26) Ibid., 86.
- (27) Wood-Brown, 300.
- (28) Ibid.
- (29) Walker, 226.
- (30) Ibid., 138.
- (31) King, 98.
- (32) Saalman, 94.
- (33) Ibid.
- (34) Ibid.
- (35) Saalman, 124.
- (36) Ibid.
- (37) Eugenio Battisti, Filippo Brunelleschi, (New York: Rizzoli International Publications, Inc., 1981), 142.
- (38) Walker, 140.
- (39) Saalman, 134.

(40) King, 182.

(41) Walker, 153.

(42) Ibid., 156.

(43) King, 197.