

Brunelleschi, Filippo

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(*b.* Florence, Italy, 1377; *d.* Florence, 16 April 1446)

architecture, engineering, geometry.

While Brunelleschi was undoubtedly the first great Renaissance architect, it remains difficult to assess his importance to the history of science, and in particular to the development of a systematic mathematical perspective. Most of what is known of his life and work is derived from Vasari's *Lives of the Artists*, a book perhaps more notable for its charm than for its accuracy.

Brunelleschi was born into comfortable circumstances; his father, Ser Brunellesco di Lippo Lapi, was a notary and his mother, Giuliana, was a member of the noble Spini family. He had to abandon his formal education at an early age, but showed so much artistic talent that his father apprenticed him to a goldsmith.

Here, according to Vasari, "having become skilled in setting stones, and in niello work, and in the science of the motion of weights and wheels, not content with this, there awoke within him a great desire for the study of sculpture." It may well be that the mechanical knowledge gained in his apprenticeship aided Brunelleschi in the design and construction of engineering devices; certainly, he made some remarkable clocks.

The relationship between the craft of the goldsmith and the art of the sculptor in the fifteenth century is defined by the competition, open to both sculptors and goldsmiths, held in Florence in 1401 for the design of a pair of doors for the baptistery of the church of S. Giovanni. The sculptor [Lorenzo Ghiberti](#) won the commission and Brunelleschi, who had also submitted a design, went to Rome with the sculptor Donatello to study architecture. From 1402 to 1418, Brunelleschi lived alternately in Rome and Florence. It was perhaps during this period that, during one of his residences in Florence, he met Paolo dal Pozzo Toscanelli and learned geometry from him. He may also have learned some of the principles of perspective from Toscanelli; at any rate, Vasari states that he not only studied perspective, but also taught it to his friend Masaccio.

Vasari also tells of a meeting of architects and engineers in Florence in 1407 for the purpose of determining how to complete the cathedral of Sta. Maria del Fiore. The medieval architects of the building had intended a dome to be built over the crossing of the cathedral, but the problem of how to erect such a dome had never been solved. Brunelleschi entered the open competition for the design of the dome in 1418—Vasari says that he had already built a model for it—and won. He undertook the work in partnership with his rival Ghiberti, but the latter withdrew from the project. Brunelleschi worked on the cathedral dome from 1420 until his death, just after the lantern had been begun. He did not, as some sources suggest, rediscover the dome, but rather he invented a technique for building it without scaffolding.

Besides his work on the cathedral, Brunelleschi designed notable secular buildings—of which the Ospedale degli Innocenti is perhaps the outstanding example—and carried out military commissions. He may have drawn the plans for the fortress of Milan, constructed by the Sforzas; in 1415 he fortified the Ponte a Mare, and in 1435 he worked on the fortress of Vicopisano. Brunelleschi also worked on the fortification of the old citadel of Pisa and furnished the plans and built the model for the fortifications of the port of Pesaro. It seems likely that he always started such work with the construction of small-scale models; certainly he used such a model for the double dome of Sta. Maria del Fiore.

While many authors have considered Brunelleschi's chief scientific contribution to be his pioneering work in perspective (Vasari even credits him with the invention of monocular perspective), recent research has assigned him a more modest part. As an architect, Brunelleschi was certainly concerned with mathematical proportion, and from this an interest in the theory of perspective may well have been born. And in the Florence of the time, marked as it was by a self-consciously Academic exchange of ideas among artists and scientists, perspective would almost undoubtedly have been a subject for discussion; we know, for example, that Paolo Ucello was simultaneously at work on the problem, and eventually published a treatise on perspective projection that almost certainly incorporated many of Brunelleschi's ideas.

Brunelleschi's initial experiment in perspective may have been his ingenious painting of the baptistery as viewed from the porch of the cathedral. This painting, carefully rendered in perspective, was mounted on a thick wooden panel. A hole was then drilled through the panel at precisely the point that represented the eye of the artist. The aperture was, at the back of the panel, approximately the size of a lentil and widened to an opening about the size of a ducat at the front. The painting was placed to face a perpendicular arrangement of mirrors; when the viewer placed his eye to the hole at the back of the painting, he saw, through an optical illusion, the scene in three dimensions. (Brunelleschi made a second such picture showing the palace of the Signiory, while Alberti made one of St. Mark's Square in Venice.)

Brunelleschi thus demonstrated his knowledge of conical projection and vanishing points, although it is possible that the concept of the optic box was Toscanelli's, and that Brunelleschi simply made it a reality. In any event, the idea of such a device, known to the ancients, may well have been drawn from the common scientific fund of the fifteenth century.

BIBLIOGRAPHY

The bibliography on Brunelleschi is not very extensive. His life as reported by Vasari has been followed by nearly all of his biographers. The most complete work so far is Venturi, *Brunelleschi* (Rome, 1923). Studies dealing with perspective are G. C. Argan, "The Architecture of Brunelleschi and the Origins of the Perspective Theory in the Fifteenth Century," in *Journal of Warburg and Courtauld Institutes* (1946); and J.B. Lemoine, "Brunelleschi et Ptolémée. Les origines géographiques de la 'boîte d'optique,'" in *Gazette des beaux arts* (1958). One might also consult Francastel, "Naissance d'un espace. Mythes et géométrie du quattrocento," in *Revue d'esthétique*.

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