Molecular biology revolutionized the way we look at other sciences related to medicine, including biochemistry. Currently, genetic testing is fast becoming a routine laboratory tool, and it is the foundation for developing personalized treatments. Revolutions, or paradigm changes, both in art and science have always been a combined result of the work of exceptional individuals, interdisciplinary interactions, and the dynamics of funding and patronage.

It is interesting to recall an all-encompassing revolution in the arts, which happened around 600 years ago, at the beginning of the Italian Renaissance. Florence, one of the Italian city-states, was then a cultural microcosm with an extraordinary concentration of both artists and wealth—and also strong civic pride, which was to an important extent expressed through arts and architecture (1). It was there that the application of mathematics to painting dramatically changed the way painters represented space.

At the beginning of the 15th century, 2 painting styles were predominant in Italy: one being the traditional Byzantine painting emanating from Constantinople, the other an interesting mix of the Byzantine style and northern European realism, resulting in a highly decorative International Gothic. The Renaissance was a cultural rebellion against the artistic paradigm of the Eastern Roman Empire—the “Maniera Graeca,” as it was called. In literature, Dante pitted the Italian language against the universally used Latin, and in sculpture, Donatello returned in his work to Roman realism.

The transformation that took place in painting was perhaps the most striking. In the space of a few decades the painting style changed from symbolic Byzantine representation to realism, making it increasingly possible to provide an accurate record of the real world.

The realistic rendering of 3-dimensional subjects on a 2-dimensional surface had been tried before. Ancient Greek vase painting, in its later stages, shows attempts at depicting depth and the use of foreshortening. Later, empirical elements of perspective, together with the use of light to model the volumes, were seen in the paintings of Giotto and others. However, the dramatic change in representation occurred when, around 1413, Filippo Brunelleschi (1377–1446) in Florence developed the principles of geometric linear perspective (2). The construction of one-point perspective was later described in the treatise “On Painting” by Leon Battista Alberti, published in 1435–1436 (3). It influenced painters well into the 18th century.

Giorgio Vasari (1511–74) published his “Lives of the most excellent painters, sculptors and architects” in 1550, with the second, enlarged edition following in 1568. He provides a fascinating account of Brunelleschi’s achievements (4). Brunelleschi became a master goldsmith in Florence in 1398 before devoting himself to architecture (4, 5). He spent some time in Rome studying ancient buildings. In 1401 he was one of the competitors who applied to decorate the doors of the Baptistery, a building on Piazza di San Giovanni, which faces the west facade of the Florence Cathedral. The contest was won by Lorenzo Ghiberti. With time Brunelleschi became the leading Florentine architect. His first major building commission was the Foundling Hospital (Ospedale degli Innocenti; 1419 to ca 1445). He designed several chapels, including the Barbadori chapel in the church of Sta Trinita, and the Pazzi chapel in the basilica of Sta Croce. He rebuilt the basilica of St Lorenzo and later the church of Santo Spirito. His main contribution was the construction of the monumental dome for the Cathedral, the planning for which started in 1418. Brunelleschi personally oversaw the main part of its construction, although the project was finished after his death. Vasari describes the initial reluctance of the Florentines to Brunelleschi’s innovative ideas, and his long rivalry with Ghiberti who for a time was imposed on him as a coleader of the project (4). His description of the linear perspective could have been influenced by discussions with the mathematician Paolo Dal Pozo Toscanelli (1397–1482).

Brunelleschi was a close friend of Donatello and the painter Masaccio (1401–1428). He taught Masaccio the principles of perspective, which Masaccio applied in his works. Masaccio was later regarded in Florence as the...
painter who made painting realistic. He was born in a small town called Castel San Giovanni di Altura (now San Giovanni Valdarno), around 30 miles south of Florence, and became a member of the Florentine guild of painters in 1422. His main legacy in Florence is the Trinity fresco in the church of Sta Maria Novella (Fig. 1) and the paintings in the Brancacci Chapel in Santa Maria del Carmine (6, 7). The Trinity shows both the realistic rendering of figures, their stances, gestures, and facial expressions, and the application of linear perspective to the architectural elements such as the barrel-vaulted ceiling. There was a strong culture of learning from older masters in Florence: the paintings of Masaccio were intensively studied and became an inspiration for the next generation of painters, including Michelangelo Buonarotti.

The extraordinary achievements of renaissance Florence resulted from the concentration of talented individuals attracted by the demand for, and sponsorship of, art and architecture. Even in today’s world of global networks, it can remind us of the importance of the interdisciplinarity and cross-fertilization of ideas.

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