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Art and Mathematics: The Platonic Solids

Michele Emmer

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In lieu of an abstract, here is a brief excerpt of the content:

Leonardo, Vol. 15, No. 4, pp. 271-282, 1982 Printed in Great Britain 0024-094X/82/040277-06 \$03.00/0 Pergamon Press Ltd. ART AND MATHEMATICS: THE PLATONIC SOLIDS Michele Emmer” The mathematician’s patterns, like the painter’s or the poet’s, must be beautiful; the ideas, like the colours or the words, must fit together in a harmonious way. Beauty is the first test: there is no permanent place in the world for ugly mathematics. (G. H. Hardy) [1] It can be said that for thousands of years there has been an interest in geometrical plane shapes and solid forms, in particular, those possessing regular features of proportion and symmetry. In the famous battles by the painter Paolo Uccello (1397-1475) ‘The Rout of San Romano’, panels of which are now distributed among the National Gallery in London, the Louvre in Paris and the Uffizi in Florence, we can see the great fascination geometric forms had for the artist (Fig. 1). This fascination was so great that Vasari, in his biography of Uccello [2], wrote that he seemed more a mathematician than an artist. He might have made the same observation about many Renaissance artists who took particular interest in the perspective of geometric shapes. Uccello was particularly attracted by the form called ‘mazzocchio’ (Fig. 2), which we can find not only in ‘The Rout of San Romano’ but also in ‘The Flood and the

Recession of the Flood' in Santa Maria Novella in Florence [3]. This drawing of Uccello is now preserved at the Uffizi in Florence. Others are at the Louvre in Paris. The words of the mathematician G. H. Hardy can be applied to many other artists, not only in ancient times but also to contemporary artists who have been interested in mathematics [4], in particular the regular or Platonic solids. Nobody knows who was the first who noted that the number of regular polygons, like triangles, squares, pentagons, hexagons and so on, goes on to infinity; but the really fascinating discovery was that the number of regular solids is finite. This fact fascinated Plato (427-348 B.C.), who related the regular solids to the structure of the world and the elements of the physical space. In his dialogue *Timaeus* we find the oldest known description of the five regular solids, although they were well known to the Pythagoreans. In ancient times the use of objects with polyhedral forms was widespread. The mathematician H.S.M. Coxeter, in his book *Introduction to Geometry* [5], says that 'a pair of icosahedral dice of the Ptolemaic dynasty can be seen in one of the Egyptian rooms of the British Museum in London.' Coxeter, in his *Regular Polytopes* [6], says that 'Excavations on the Monte Loffa near Padova have revealed an Etruscan dodecahedron, which shows that this figure was enjoyed as a toy at least 2500 years ago.' While Coxeter and I were making a movie of the series 'Art and Mathematics' on Platonic Solids, he told me that he was unable to remember where he had seen this object. Paola Gario, in her book on the history of polyhedra [7], gives other information on the ancient polyhedra. She speaks of two perfectly regular dodecahedra of Celtic origin, in the Louvre [8]. A more recent example (11c; b.C.) is preserved in the Rheinisches Landesmuseum in Bonn. It is the only one of its kind in Western Germany. It has a dodecahedral form with 277 holes of different shapes on its faces. We do not know what it was used for (Fig. 3). The article by F. Lindemann 'Zur Geschichte der Polyedere und der Zahlzeichen' [9] gives additional interesting information.

Fig. 1. P. Uccello. 'The Rout of San Romano', Painting, oils on wood, 182x322cm. 1451-1457. Fig. 2. P. Uccello, 'Mazzocchio', drawing, 1430-1440. (Photo: Gab. for. Soprintendenza Beni Artistici e Storici di Firenze.) Fig. 3. Anon. 'Dodecahedron'. 8 x 7 x 7cm, 2nd century B.C. (Rheinisches Landesmuseum, Bonn, Fed. Rep. Ger.)

218 Michele Emmer, *Talk about ancient polyhedra*. This is how Plato himself describes the five regular solids in the *Timaeus*. First, the Creation: 'But...

ART AND MATHEMATICS: THE PLATONIC SOLIDS

Michele Emmer*

The mathematician's patterns, like the painter's or the poet's, must be beautiful; the ideas, like the colours or the words, must fit together in a harmonious way. Beauty is the first test: there is no permanent place in the world for ugly mathematics.

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Fig. 1. P. Uccello, 'The Ruin of San Romano', Painting, oil on wood, 142 x 222 cm, 1431-1475.

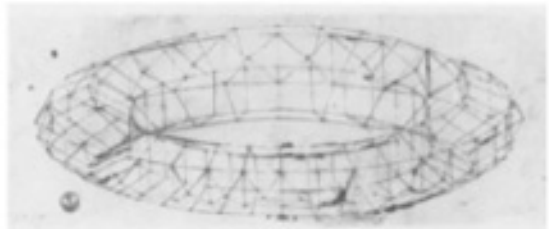


Fig. 2. P. Uccello, 'Mazzocchio', drawing, 1420-1440. (Photo: Gab. fot. Soprintendenza Beni Artistici e Storici di Firenze.)

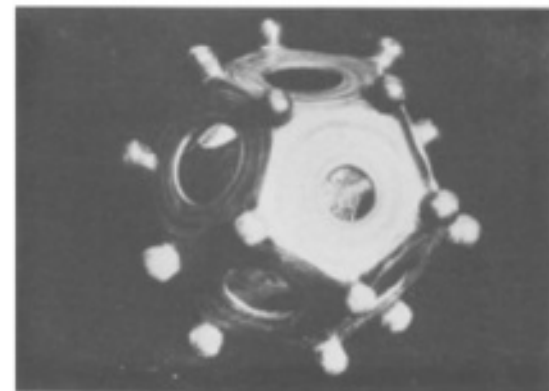


Fig. 3. Etruscan 'Dodecahedron', 8 x 7 x 7 cm, 2nd century B.C. (Rheinisches Landesmuseum, Bonn, Fed. Rep. Ger.)

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Seurat and Piero della Francesca, front is unlimited from the top.

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