The Polyhedrists by Noam Andrews

Reviewed by Amites Sarkar

A few months ago, I came across a YouTube video entitled "Paul McCartney's Piano Lesson," in which the renowned musician discusses songwriting at the piano. While on the topic of Bach and Eleanor Rigby, McCartney explains, "what I liked about it was the mathematical thing... mathematics – it's all happening together so it gives this lovely feel of something satisfying."

For me, having spent half a lifetime failing to persuade anybody that mathematics is an art, McCartney's words struck an odd chord. But *The Polyhedrists: Art and Geometry in the Long Sixteenth Century* (MIT Press), by the art historian Noam Andrews, tells a similar story. One of the major themes of the book is that in 16th century Italy and Germany, artists, not mathematicians, were the stewards of three-dimensional geometry. Liberated from Book XIII of Euclid's *Elements* by Piero della Francesca, polyhedra soon started to appear in artists' notebooks, woodcuts, paintings, sculptures, caskets and cabinets. By around 1600, polyhedra were so ubiquitous that Kepler (who reclaimed them for mathematics) could ask if there was anyone "who had never seen those five mathematical bodies set in large or small half-divided globes."

In some sense, the long 16th century of the title refers to the period between Ratdolt's printed edition of Euclid's Elements in 1482 and Kepler's listing of the 13 Archimedean polyhedra in *Harmonices Mundi* in 1619. Andrews reproduces a page from Ratdolt's book, allowing us to compare Ratdolt's diagram of a dodecahedron (which looks nothing like a dodecahedron) with the artist Nicolas de Neufchâtel's (which does). No less than Leonardo da Vinci supplied the illustrations for Luca Pacioli's *De Divina Proportione* (1509), one of two books that form the focus for the first half of Andrews's book. The other is Albrecht Dürer's *Underweysung der Messung* (1525), in which the artist Dürer introduces the important mathematical concept of a polyhedral net.

One of many things I learned from *The Polyhedrists* was that Pacioli and Dürer (not to mention da Vinci) were themselves many-sided. Pacioli produced an annotated edition of Euclid's Elements in 1509, and Dürer collected many editions of the *Elements*, always seeking the most up-to-date translations. Both of them moved beyond Euclid in discovering and drawing some of the Archimedean polyhedra, whose inclusion in works of art soon came to signify the highest level of skill. For example, the portrait of Oswald von Eck with which the book opens, features a *rhombicosidodecahedron*. Why did the artist, Lautensack, include it? It had to signify something sought-after and appreciated by von Eck.

In the second half of the book, the action shifts to Southern Germany. We meet Wenzel Jamnitzer, a Nuremberg goldsmith and author of *Perspectiva Corporum Regularium* (1568), which contains etchings of no fewer than 120 stellations, truncations and variations of the platonic solids. Andrews reproduces several of these, and the MAA Treasures website features others. Next comes the lesser known artist Lorentz Stöer, whose notebooks seem to have inspired many of the Augsburg cabinet makers. Here, Andrews has done some sleuthing: he discovered minute indentations and chalk-dusted ridges in Stöer's manuscripts, indicating which drawings were copied, and which were not. The final chapter, "The Violence of Whimsy," contrasts the violence of the ivory trade with the beauty of the ornaments resulting from it. My favorite example of the latter is the series of nested ivory dodecahedra. Andrews carefully explains how the shape was made, starting with the elephant.

The Polyhedrists is a work of scholarship and exposition; the text itself is more scholarly, even exploratory, than expository. Andrews wants to make connections. Sometimes, he makes surprising ones, such as the one between Archimedean (non-Euclidean) solids, and non-Euclidean geometry. If you just want to know the mathematical and historical facts, I recommend Chapters 2 and 3 of Peter Cromwell's *Polyhedra* (1997). But if you want to immerse yourself in another world, then this fascinating and lavishly-illustrated book is for you.