Kepler’s Obsession model designed by Dr. John Conway

Kepler's first attempt to build a model of the universe with Zometool (A) with fat and skinny Richert diamonds. Assembled from pentagons, the Kepler tiling is a 2-dimensional pattern that is the basis of the 2-dimensional Penrose tiling. (2) Zometool blocks made a startling reappearance in the 20th century with Daniel Schectman’s discovery of quasicrystals. (3) Kepler blocks (B) assembled to form a rhombic triacontahedron (R), Zometool parts removed (C). (4) Illustration of Kepler’s 2nd Law: a planet sweeps out equal areas in equal times (image exaggerates the ellipse’s eccentricity). (5) Harmonices mundi in 1619. (6) One of Kepler’s most interesting findings is based on the number 5 (the “red” planet in Zometool). Assembled from pentagons, decagons and stars, it doesn’t repeat indefinitely nor articulate matching rules, but it heralded Richard and Penrose tilings of the 20th century. (7) Kepler blocks (A), assembled to form a rhombic triacontahedron (R), Zometool parts removed (C).

Kepler Blocks

Kepler also discovered the rhombic triacontahedron and its sub-units (Kepler blocks), which are 3-dimensional cousins of Richert tilings. While Richert’s tiles are 2 types of “squashed” squares (parallelograms), the triacontahedron can be built up from 2 types of “squashed” cubes (parallelepipeds), and Kepler blocks will also fill space according to matching rules just as Penrose tiles can cover a plane surface quasiperiodically.

Kepler’s Laws

1. Planets move in elliptical orbits with the sun at one focus. 2. In their orbit around the sun, planets sweep out equal areas in equal times. 3. The sum of the squares of the times that a planet takes to circle the sun is proportional to the cubes of the average distance from the sun.

Kepler’s first two laws in Astronomia nova (New Astronomy) in 1609, but didn’t articulate the 3rd until his 2nd magnum opus, Harmonices mundi (Music of the Spheres) was already on press in 1619. This contained a more elaborate model of the cosmos, and a goldmine of 2- and 3-D geometry: a proof that there are only 13 Archimedean solids! 2 new non-convex regular polyhedra, and the first orderly treatment of mathematical tilings.

The system was funded by the Dukes of Württemburg to supply Maulbronn was haunted by the ill-famed Dr. Faustus a half-century earlier. A year later, Tycho died of overindulgence. Tycho  (not a toy)

Zometool. (8) The apple blossoms approximate Kepler blocks.

The Secret of the cosmos, and a goldmine of 2- and 3-D geometry: a proof that there are only 13 Archimedean solids! 2 new non-convex regular polyhedra, and the first orderly treatment of mathematical tilings.

One of Kepler’s most interesting findings is based on the number 5 (the “red” planet in Zometool). Assembled from pentagons, decagons and stars, it doesn’t repeat indefinitely nor articulate matching rules, but it heralded Richard and Penrose tilings of the 20th century. Kepler blocks made a startling reappearance in the 20th century with Daniel Schectman’s discovery of quasicrystals. At the time, crystallography was considered a “closed” science and 5-fold crystals were known to be impossible.
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Euler's formula states for any convex polyhedron, the number of vertices and faces together is exactly two more than the number of edges. Try it!

3. Place strut in any hole.
4. Point strut at the sun.
5. Use board at 90º to light rays.

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2. Point strut at the sun.
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The planetary motions are thus nothing else than a continuing, polyphonic music (perceived by the mind, not the ear); a music, which progresses through dissonant tensions, as if by syncopations and cadences (as Man uses these, in imitation of those natural dissonances), toward certain predetermined points of completion; and by doing so, sets its various marks onto the immeasurable expanse of time.

– Johannes Kepler, Harmonices mundi, 1619

Zometool Kepler's Obsession Project — Dr. John Conway, concept; Dr. Scott Vorthmann, vZome software for images; Anni Wildung, graphic design; Paul Hildebrandt, copywriting and project management. Zometool Kepler’s Obsession Project is an Imagination Stage project led by Steve Baer, Zomeworks Corp., USA. © 2009 Zometool Inc.