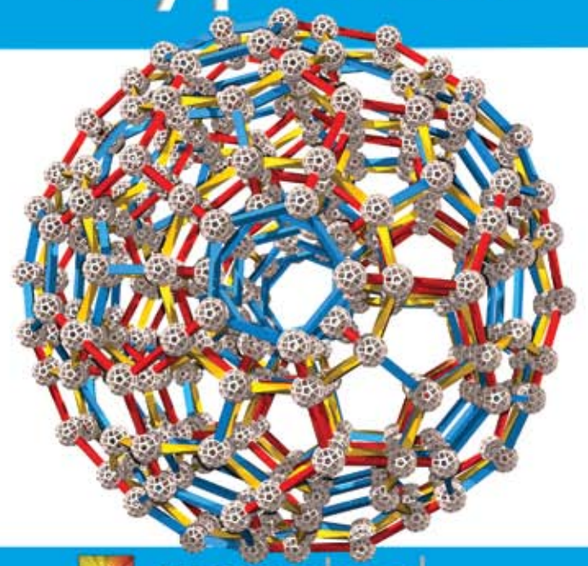
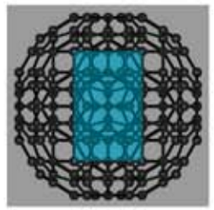
Hyperdō



zometool.com 888-966-3386



Parts: 970

330 180 200 20 120 120

Includes 970 precision Zometool components and detailed instructions by Paul Hildebrandt

It's Red 5 beamed down from the 4th dimension! Zometool takes you to hyperspace at warp speed!

In just hours, you can build this elegant and beautiful model. You'll never want to take it apart... but the parts are compatible with all Zometool kits!

- *Build a projection from the 4th dimension!*
- *Cast amazing shadows!*
- *Check out the Tunnel of Love!*
- *Learn to think in 4D!*

MADE IN USA from kid-safe materials

7 09743 20023 3

CE 0-3

WARNING: Choking Hazard CONTAINS SMALL PARTS that are NOT suitable for children under 3 years of age.

A People's History of the Hyperdo

The German mathematician Ludwig Schläfli discovered the hyperdodecahedron (120-cell) and other regular 4D shapes (polytopes) in 1852. By the 1880s, mathematicians made various models of it from materials such as paper, wire and string, some of which were sold in contemporary catalogs of mathematical models!

With no formal mathematical training, Alicia Boole Stott (daughter of George Boole, a forefather of computers) built on Schläfli's ideas in the early 20th century. She introduced "polytope" to the English language and collaborated with the great geometer H.S.M. Coxeter. Coxeter's classic Regular Polytopes includes a photo of a hyperdocahedron "shadow," one of a series of spectacular wire models of 4D figures built by Paul S. Donchian in the 1930s .

In the late 1960s, Steve Baer and associates discovered the 31-zone system, publishing their work in Zome Primer. Integrating Regular Polytopes and Zome Primer, Zometool Inc. cofounder Marc Pelletier discovered (at age 17) the lengths and directions outlined by Baer align exactly with special 3D shadows of the 120-cell and related polytopes.

Baer's "Zometoy" kits were not available to Pelletier so he built a cardboard "sketch" of the hyperdo to verify his thesis.

Pelletier met Paul Hildebrandt in 1980. They immediately set out to adapt Baer's geometry to a "friendlier" version of the Zometoy. "Zometool"was introduced in 1992, with color- and shape-coded parts that make it simple to build the Hyperdo. In fact, there is a family of 15 related polytopes—including "truncations" and "expansions"— all of which be can built with Zometool.*

Donchian took about 2 years to build his wire model. The Zome Hyperdo takes 2-4 hours to build, depending on your experience. Scott Vorthmann holds the virtual record, building a Hyperdo in less than 5 minutes using his vZome computer program (available at vorthmann.org/zome; our ZomePad software is available at zometool.com). Pelletier built and dedicated a stainless steel Hyperdo model to Coxeter at the Fields Institute shortly before Coxeter's death in 2003.

For more about 4D geometry, try Thomas Banchoff's Beyond the Third Dimension and H.S.M. Coxeter's Regular Polytopes. See a detailed history of the 120-cell at George Hart's "4D Polytope Projection Models by 3D Printing" at http://www.georgehart.com/hyperspace/hart-120-cell.html, from which this text was adapted.


Schläfli


Boole Stott


Coxeter


Donchian


Baer


Pelletier

Thanks to Scott for vZome, TWH and HRTH for testing these instructions, and Marc for photos of Coxeter and Donchian, historical tidbits and teaching me everything about Zometool -- PH

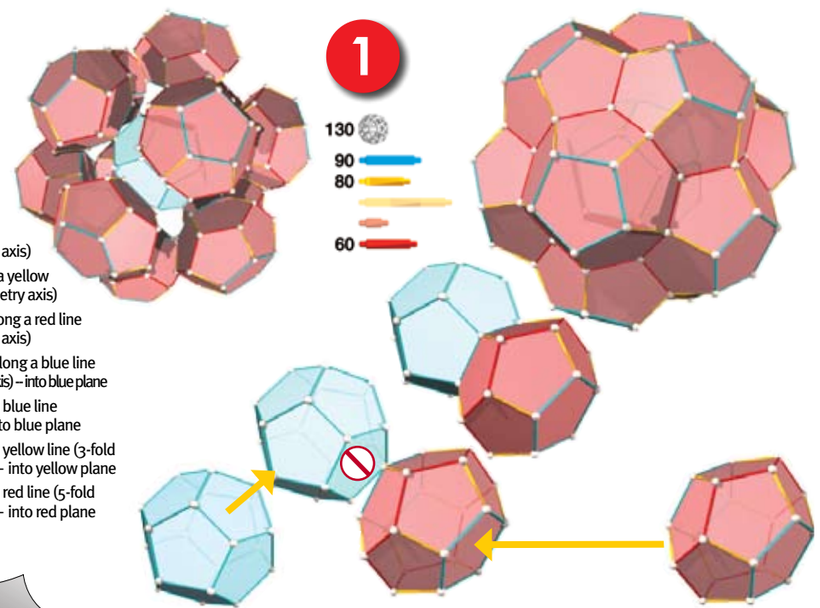
*Some require tens of thousands of parts (please call 800-966-3386 for a quote!)

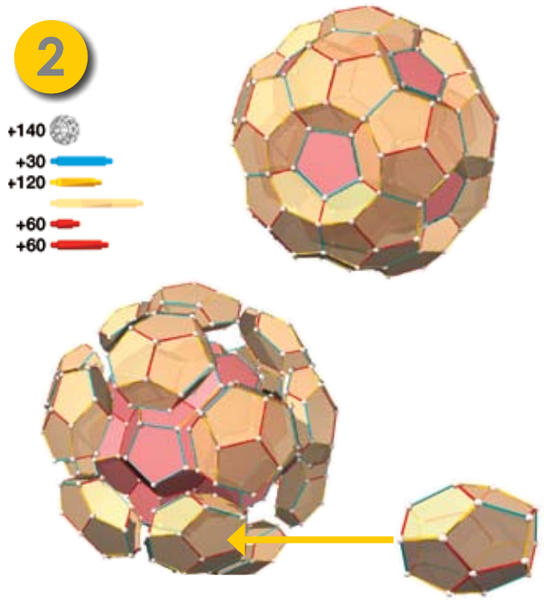
Note: *assembly shows hyperdo built with struts two Golden Mean power larger (2.618x)*

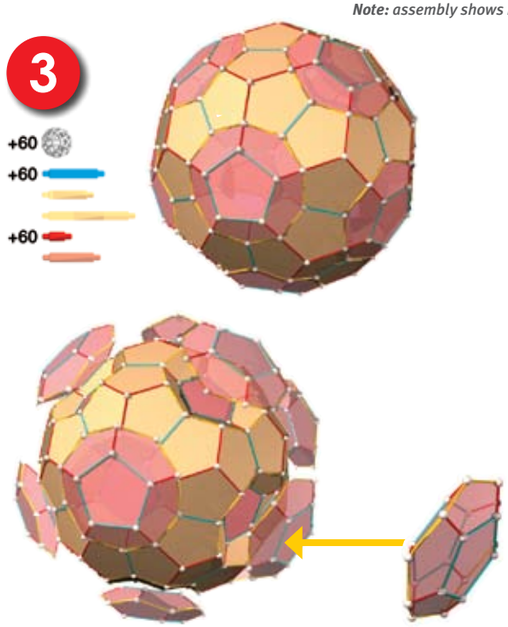
LEGEND

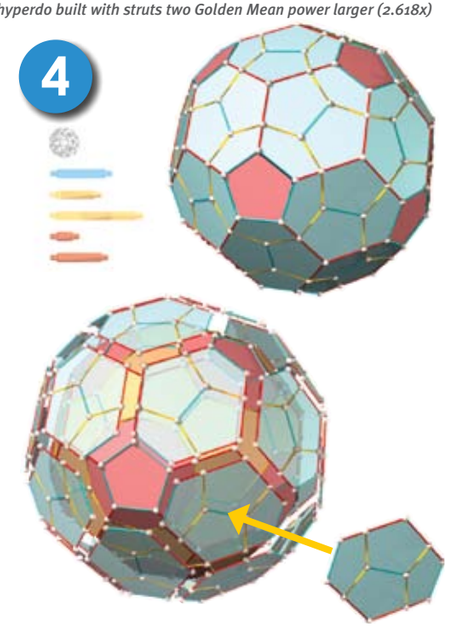
- Remove part(s)
- Change model orientation
- Regular or semi-regular
- Perspective projection
- "Fat" squash along a red line (5-fold symmetry axis)
- Squashed along a yellow line (3-fold symmetry axis)
- "Thin" squash along a red line (5-fold symmetry axis)
- Squashed (flat) along a blue line (2-fold symmetry axis) – into blue plane
- Projected along a blue line (2-fold axis) — into blue plane
- Projected along a yellow line (3-fold symmetry axis) — into yellow plane
- Projected along a red line (5-fold symmetry axis) — into red plane

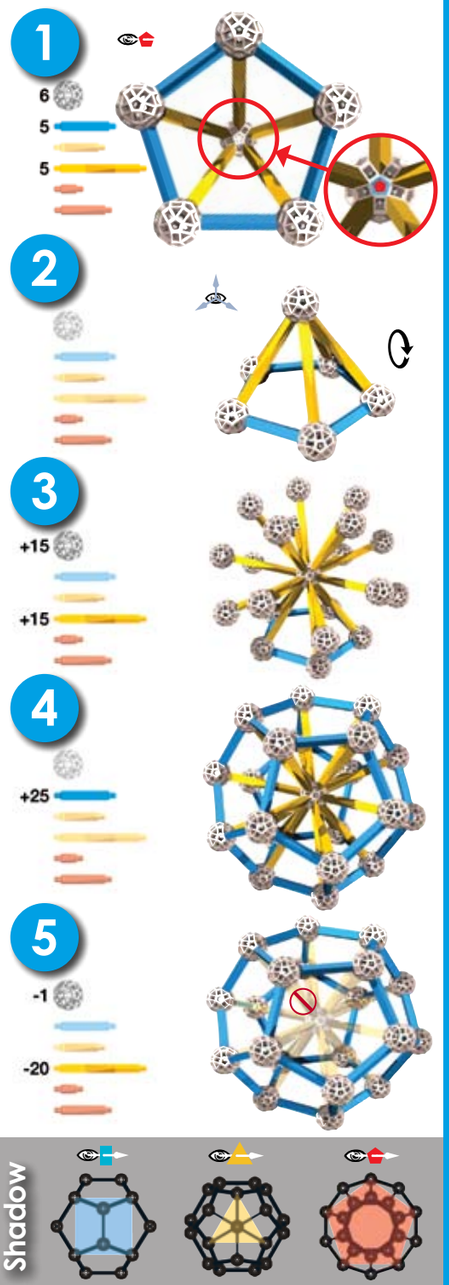
START Inside!



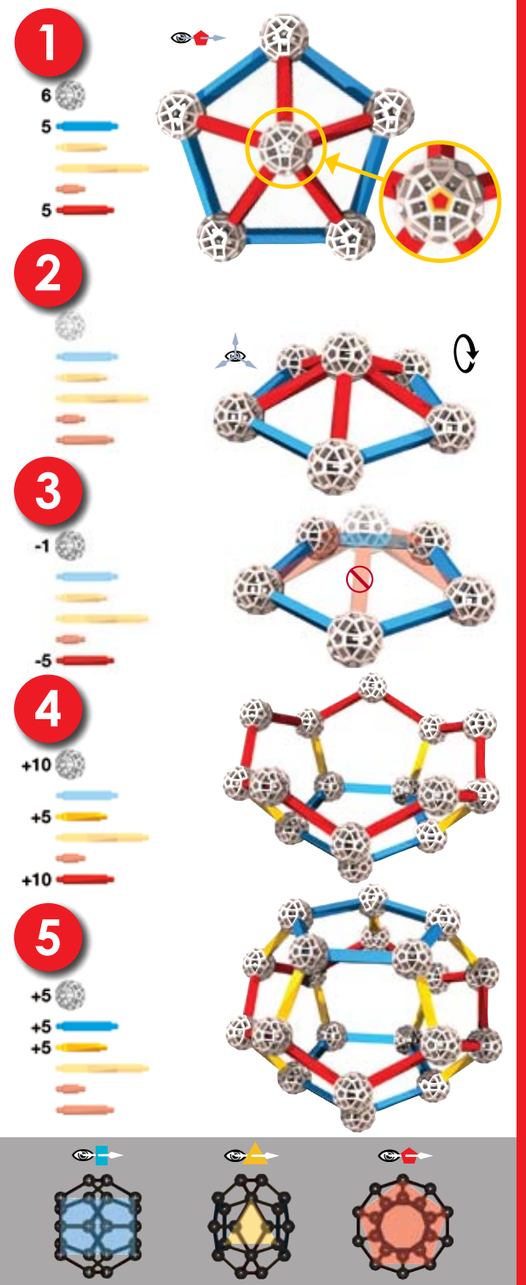




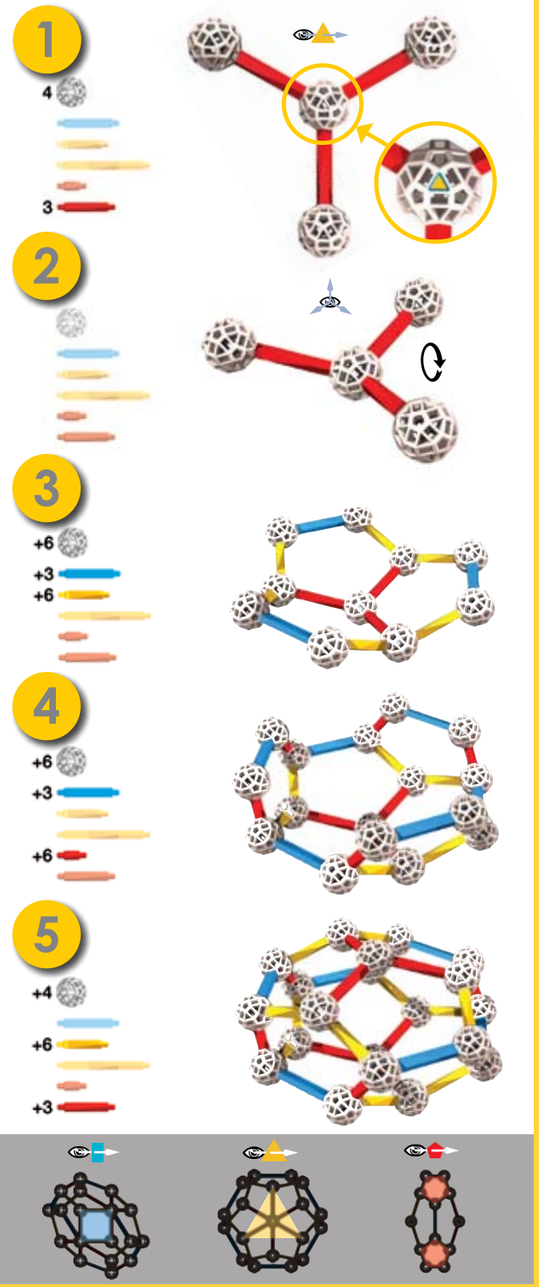




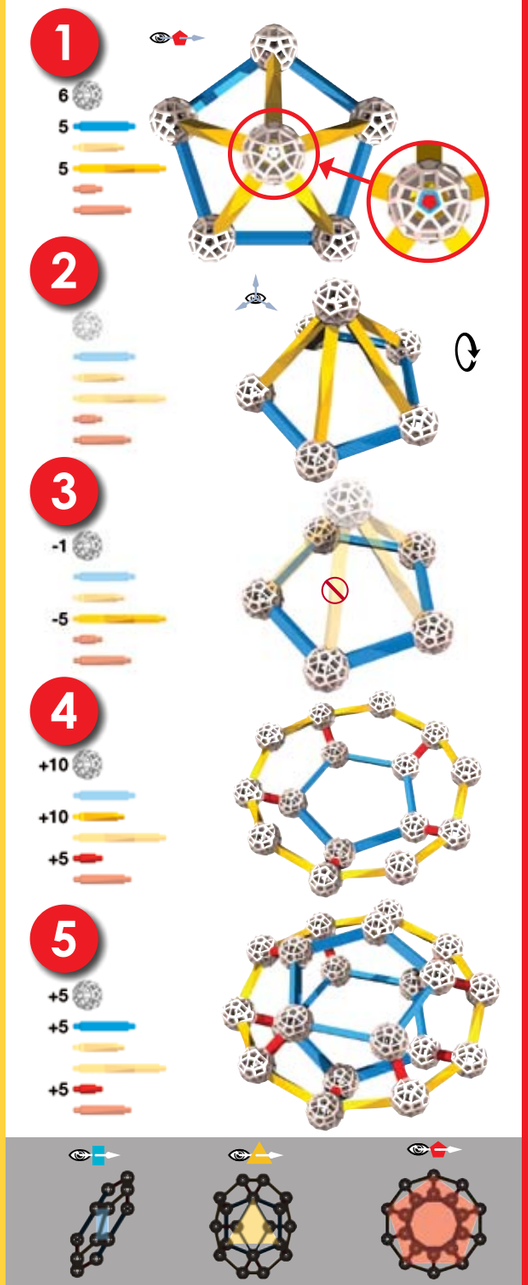
Dodecahedron



Fat Red Cell



Yellow Cell



Thin Red Cell

START HERE!

HYPERDO

The easy way -- just as you could think of a pentagon as a 2-dimensional number 5 and the dodecahedron as a 3-dimensional number 5, think of the the Hyperdo as a 4-dimensional number 5!

Start with a pentagon -- it's made of 5 blue struts joined by five balls. Use a yellow scaffold! Next, build a **dodecahedron** from *12 regular pentagons* joined edge to edge. Now you're ready to master the 4 squashed dodecahedral cells on this page.

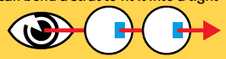
The Hyperdo is made up of *120 dodecahedral cells* joined face to face (so it's also called a 120-cell.) You are ready to build a *3-dimensional "shadow"* of the 120-cell* by combining the cells you've mastered (see assembly steps overleaf.)
Note: you need to remove some struts to join the cells together -- and you'll finish the model before you reach the last step!

**You can only see 75 of the cells, and all but one of them has been squashed during the trip from 4 to 3 dimensions!*

ZOMETOOL RULES!

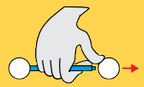
1 ***If it works, it works perfectly.***

...and if it doesn't work, it doesn't work at all. Don't force Zometool components. You can bend a strut to fit it into a tight spot, but struts in finished models are always straight, never under tension.



Hint: you can tell which strut fits between two balls in a model by lining up the balls and looking through the holes. The holes show you the shape of the strut that fits!

2 ***Don't break it apart; take it apart!***

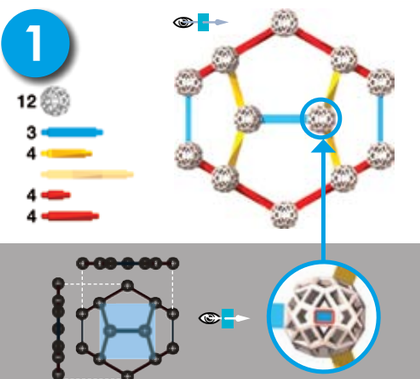


Take Zometool models apart by grasping a strut with your fingers and pushing the ball straight off with your thumb. Twisting balls, pulling models apart or crushing them can cause parts to break!*

3 ***Leave the place cleaner than you found it.***

It's always a good idea to clean up when you're done, so others can enjoy Zometool too. If we work together, we can make the world better.

** We replace accidentally broken parts for free: www.zometool.com/warranty*



Flat Blue Cell