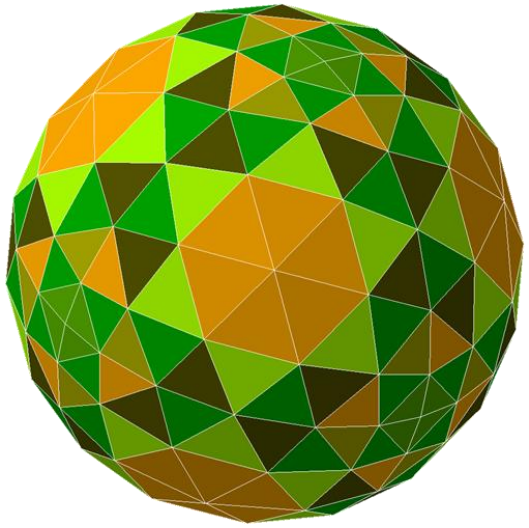
SMiA

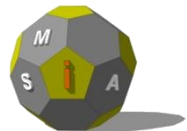
Structural Morphology in Architecture

SOLIDS



SOLIDS

¿WHY IS IT IMPORTANT?



REAL PROJECTS

EGYPT PYRAMIDS

REAL PROJECTS

HOUSE CUBE -PIET BLOM - ROTTERDAM

REAL PROJECTS

CUBE HOUSES - PIET BLOM - ROTTERDAM

REAL PROJECTS

ENDESA PAVILION - BARCELONA

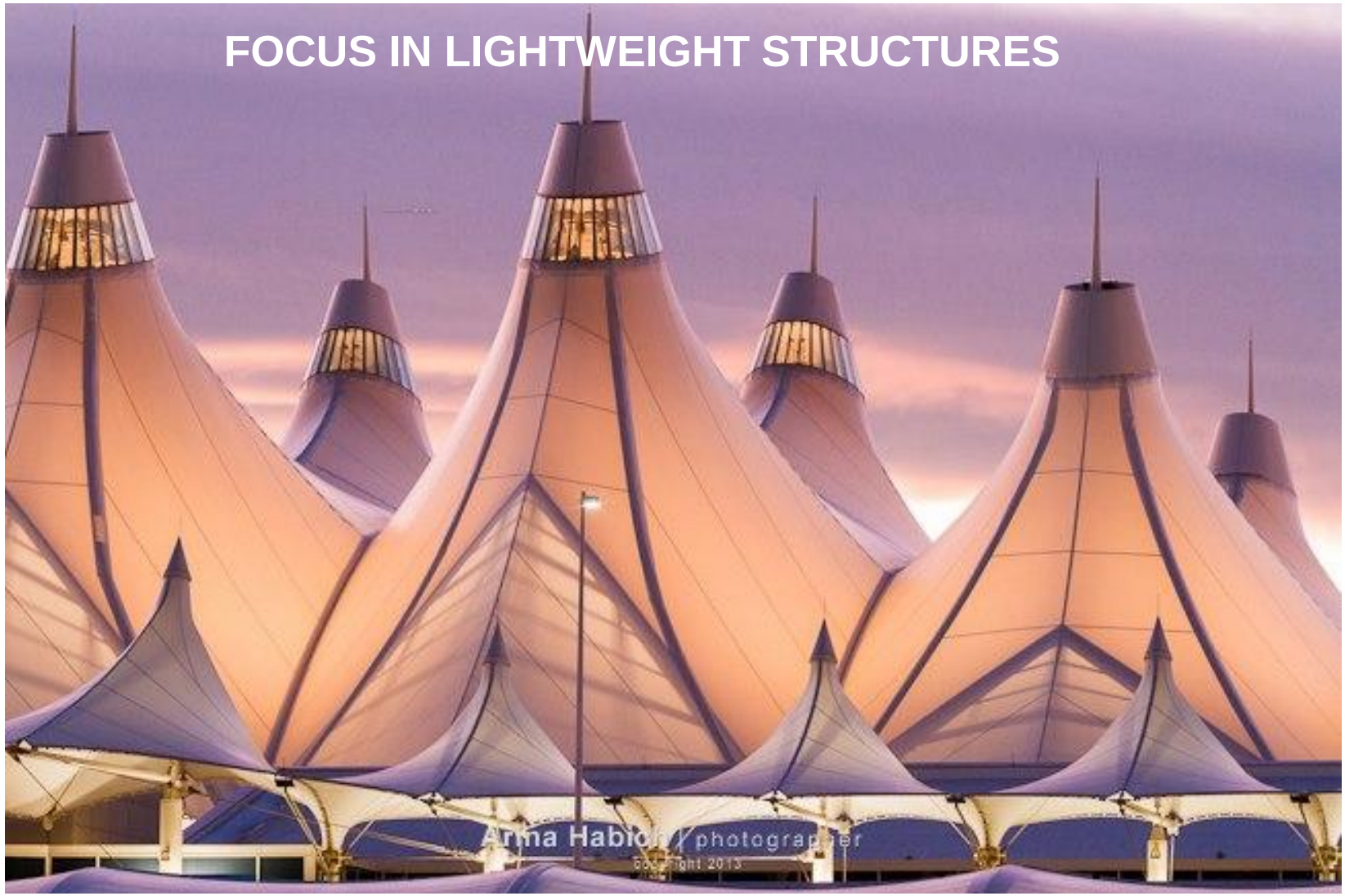
REAL PROJECTS

PHILLIPS PAVILION - BRUSSELS

REAL PROJECTS

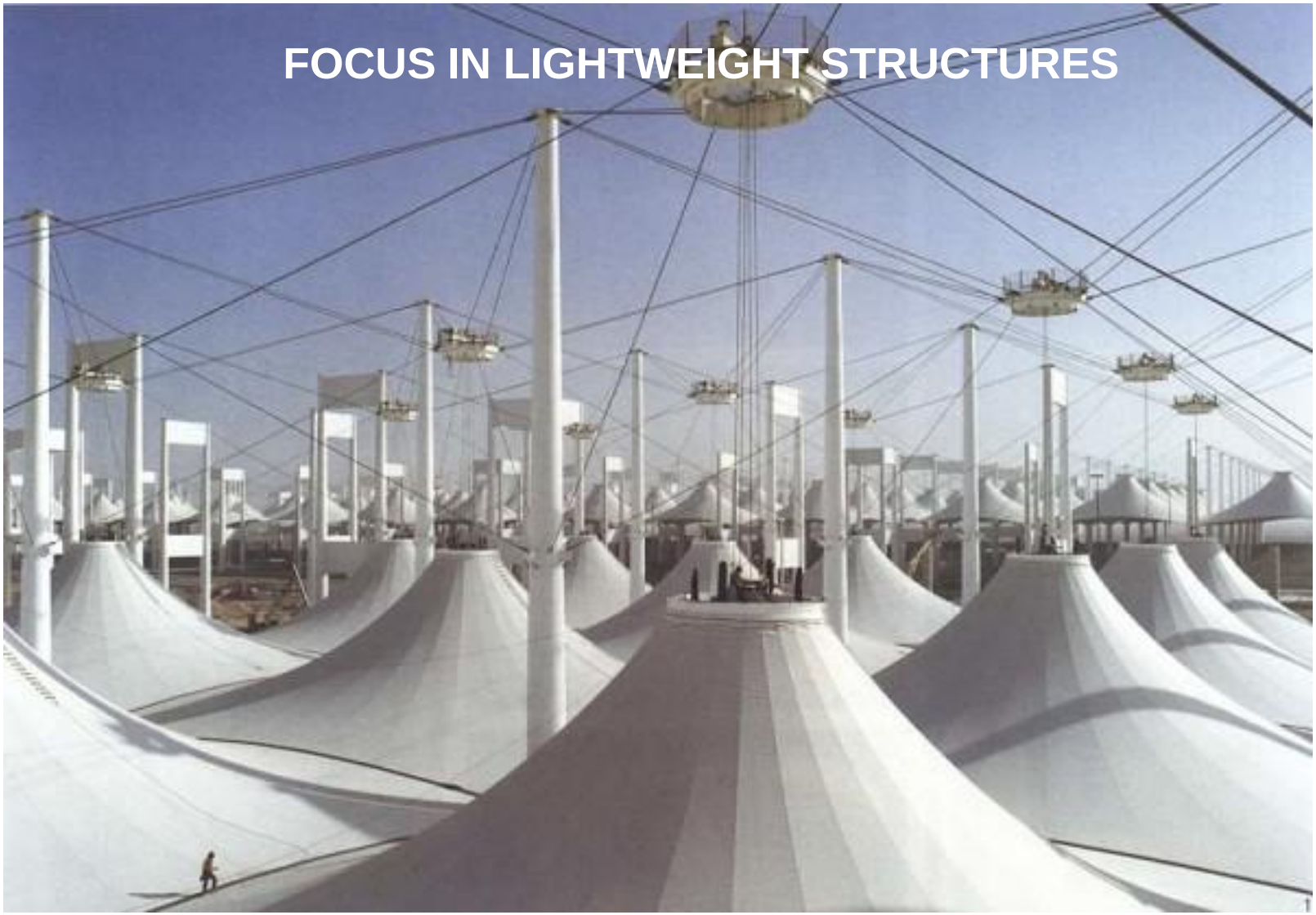
ART MUSEUM - DENVER

REAL PROJECTS



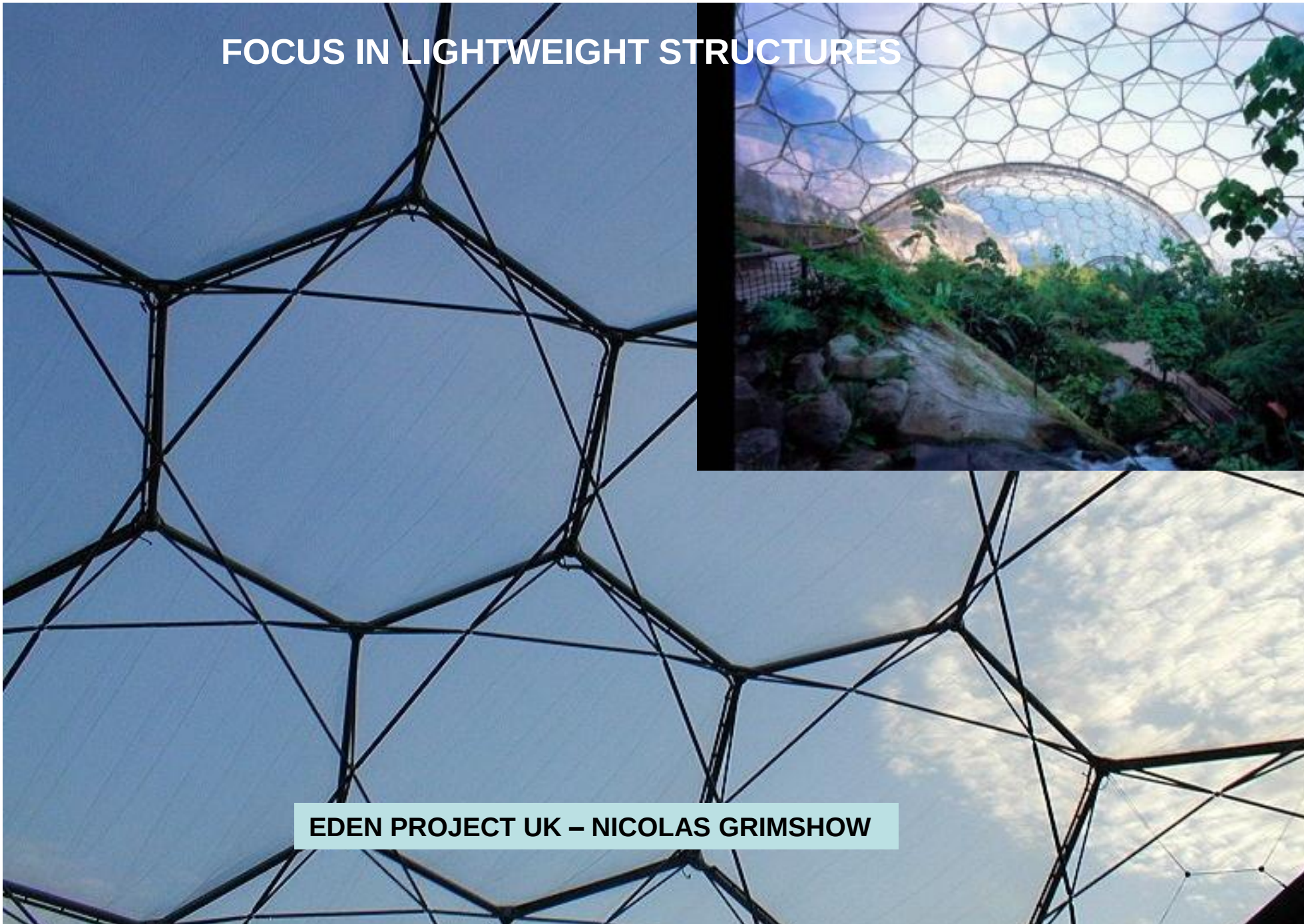
DENVER INTERNATIONAL AIRPORT - HORST BERGER

REAL PROJECTS

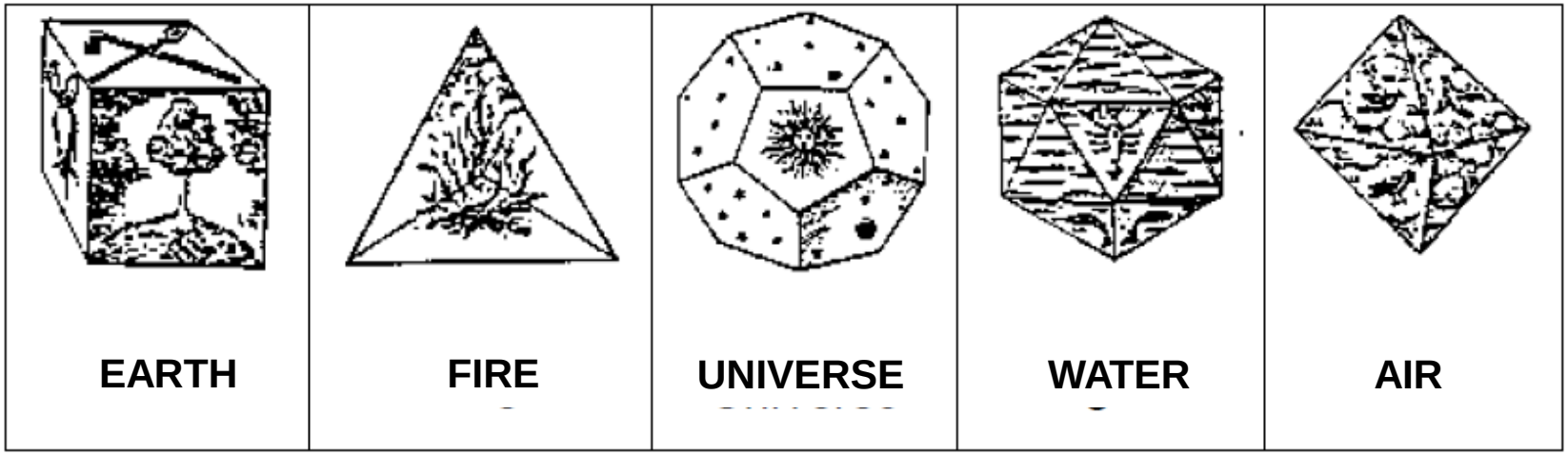


HAJ TERMINAL **JEDDAH AIRPORT SAUDI ARABIA -** HORST BERGER

REAL PROJECTS

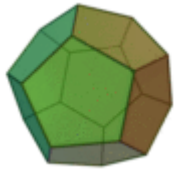


ORIGEN

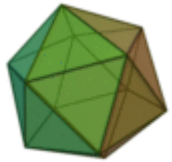


HEXAHEDRON
6 SQUARES

TETRAHEDRON
4 TRIANGLES



DODECAHEDRON
12 PENTAGONS



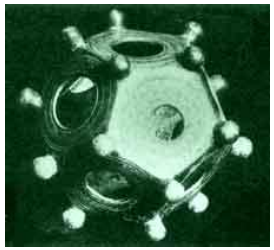
ICOSAHEDRON
20 TRIANGLES

OCTAHEDRON
8 TRIANGLES

NATURE

HISTORY

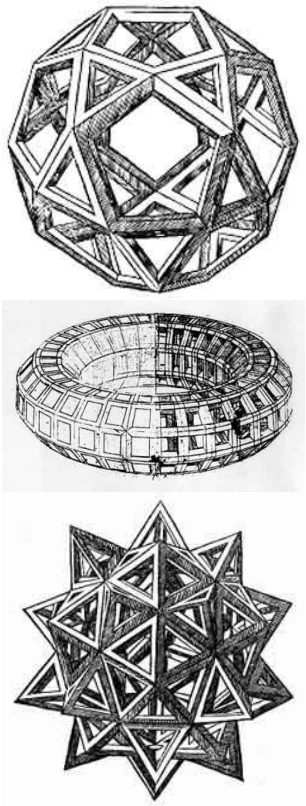
Neolithic Polyhedra



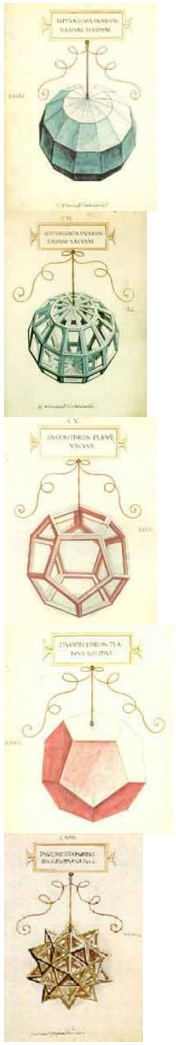
Roman Polyhedra

Renaissance Polyhedra

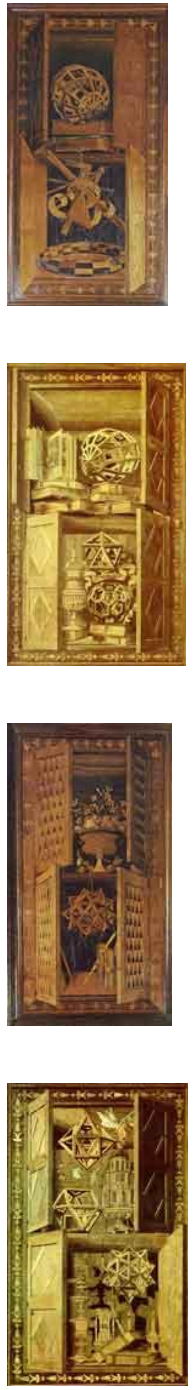
HISTORY



Leonardo da Vinci
Polyhedra



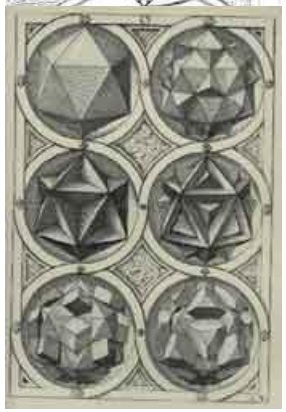
Leonardo da Vinci Polyhedra



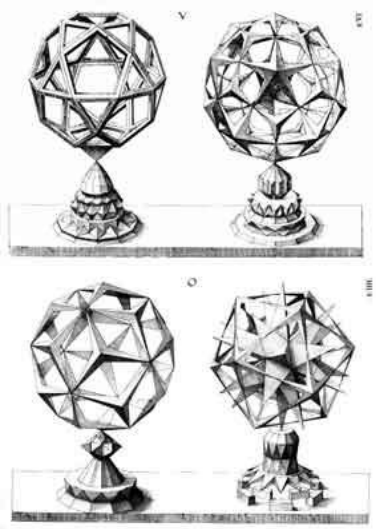
Giovanni da Verona Polyhedra

HISTORY

Alberto Durero Polyhedra



Wentzel Jaminitzer
Polyhedra



Wentzel Jamnitzer Polyhedra

Johannes Kepler (astronomer) Polyhedra

DEFINITION

The geometric forms/bodies/shapes can take two forms: **polyhedra** (made up of flat surfaces) or round (made up of curved surfaces).

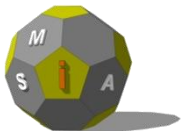
Polyhedra can have faces that are not supported. These are called **concave** and the opposite **convex**.

We are going to work with **convex polyhedra**,

The point where the faces meet is called the **vertex**.

For all **convex polyhedra**, always ensure that the number of faces plus the number of vertexes is equal to the number of edges plus two.

F+V=E+2 (Euler's Formula)



CLASIFICATION

Solids or polyhedra/polyhedrons **CLASIFICATION**:

1. **REGULAR SOLIDS:**

1.1 Platonic Solids

Dual Solids: for the Platonic polyhedra each solid has a dual.

2. **IRREGULAR SOLIDS:**

2.1 Archimedean (platonics solids truncation)

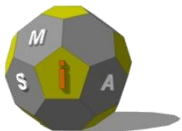
2.2 Prisms and Antiprisms (twist)

2.3 Other families:

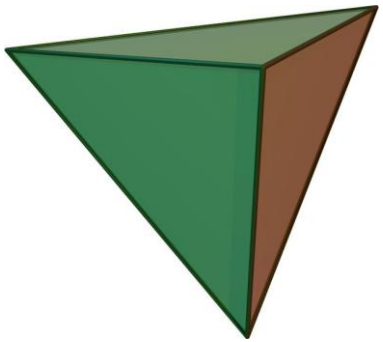
2.3.1 Catalan Solids (Archimedean duals polyhedra. All are convex polyhedra. Uniform faces but not uniform vertices).

2.3.2 Johnson Solids (92 convex polyhedron, each face is a regular polygon).

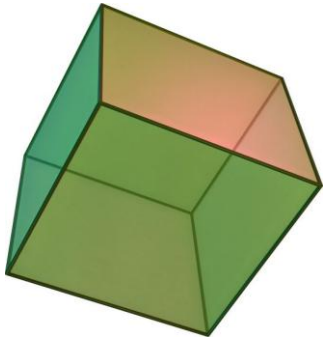
2.3.3 Dypiramids and Deltohedra



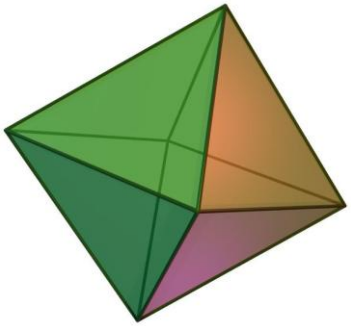
GEOMETRY



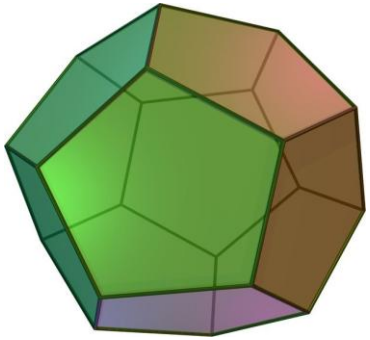
TETRAHEDRON
4 TRIANGLES
FIRE



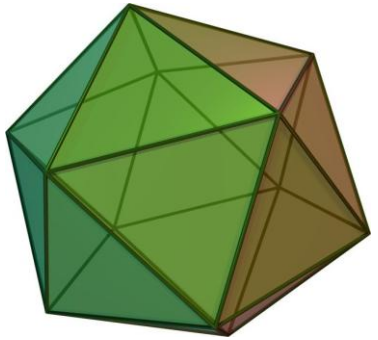
HEXAHEDRON
6 SQUARES
EARTH



OCTAHEDRON
8 TRIANGLES
AIR



DODECAHEDRON
12 PENTAGONS
UNIVERSE

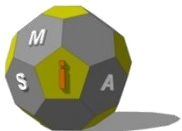


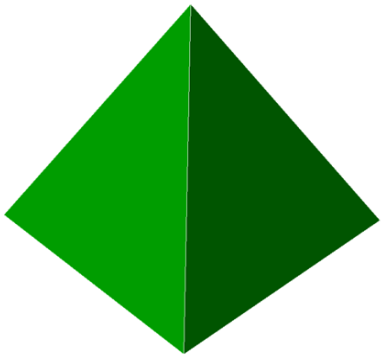
ICOSAHEDRON
20 TRIANGULES
WATER

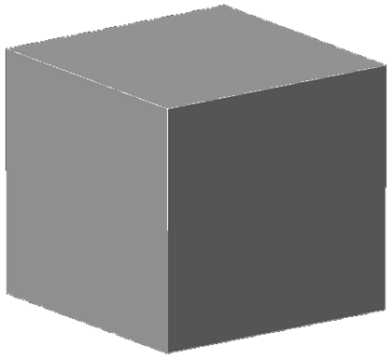
GEOMETRIC STABILITY 3V=E+6 (SCHÄFLI)

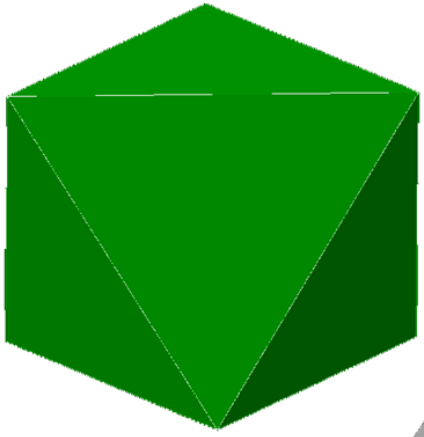
ICOSAHEDRON 3x12=30+6
36=36

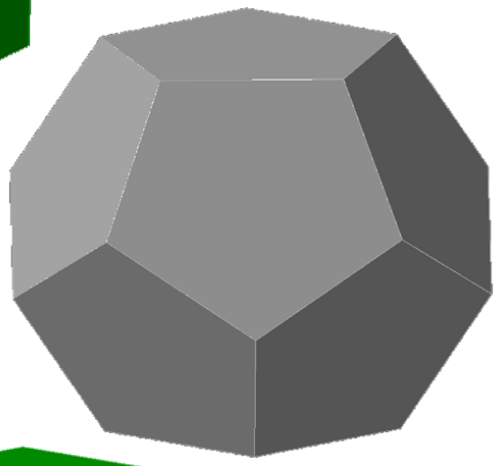
PLATONIC SOLIDS









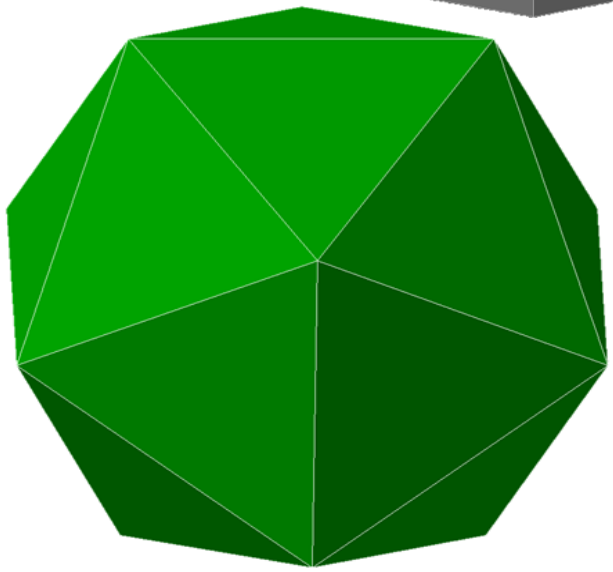


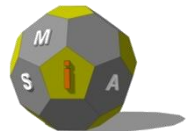
ΕΥΧΛΙΔΕΣ

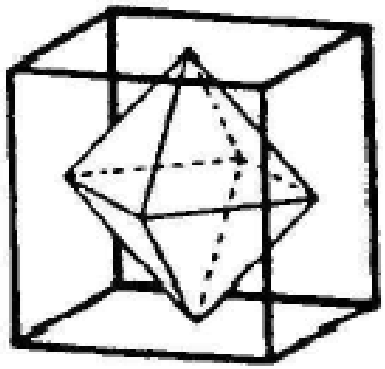
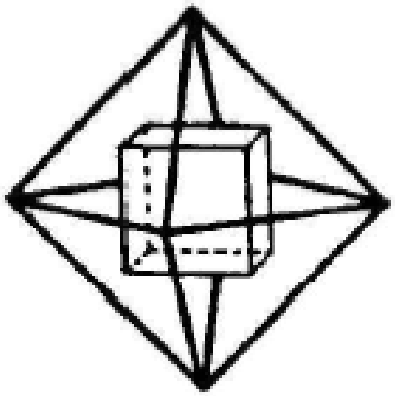
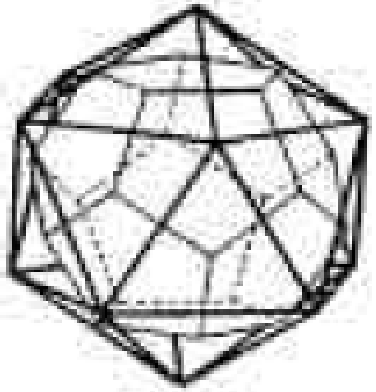
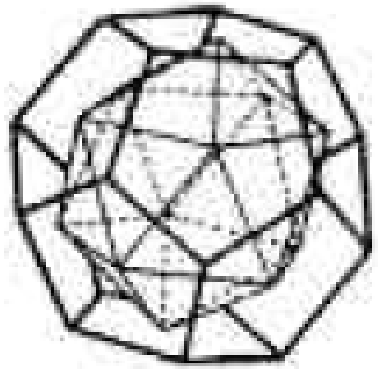
EUCLIDES

Are perfect because all their faces, edges and angles are equal.

530 b.c. Greece
Pythagorean School
Platon - Timaus (Timeo)

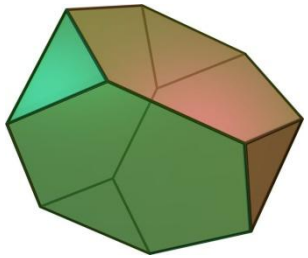




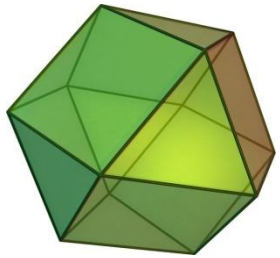





DUAL SOLIDS

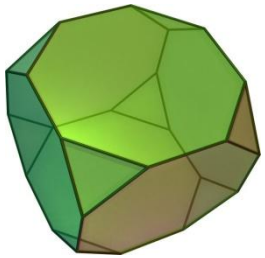
GEOMETRY



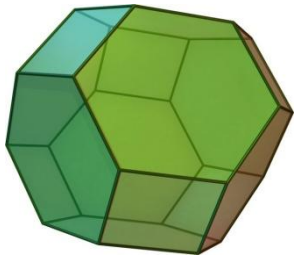
TETRAHEDRON
TRUNCATED



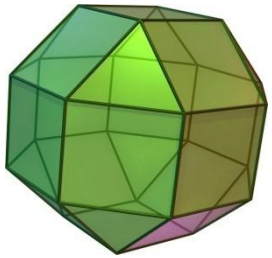
CUBOCTAHEDRON



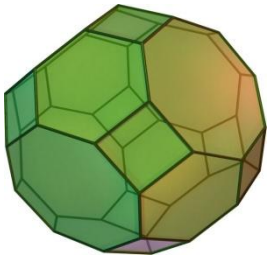
HEXAHEDRON
TRUNCATED



OCTAHEDRON
TRUNCATED

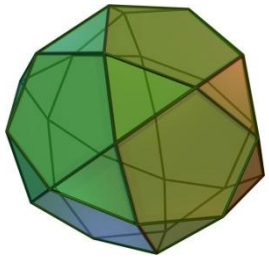


ROMBICUBOCTAHEDRON
MINOR

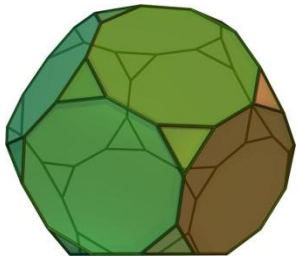


ROMBICUBOCTAHEDRON
MAJOR

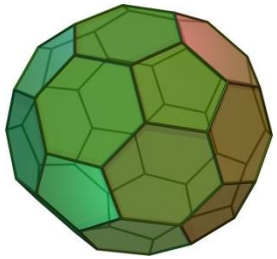
HEXAHEDRON
FLAT



ICOSAHEDRON
FLAT



DODECAHEDRON
TRUNCATED



ICOSAHEDRON
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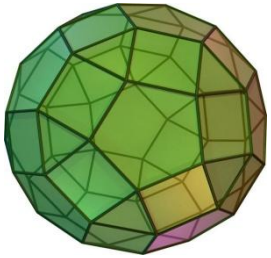
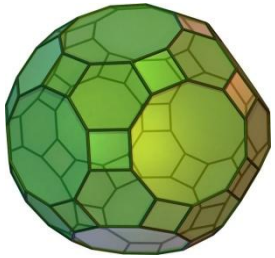
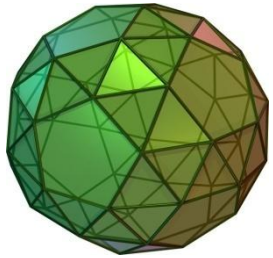


RHOMBICSIDODECAHEDRON
MINOR

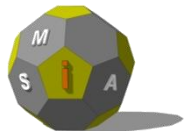


RHOMBICSIDODECAEDRON
MAJOR

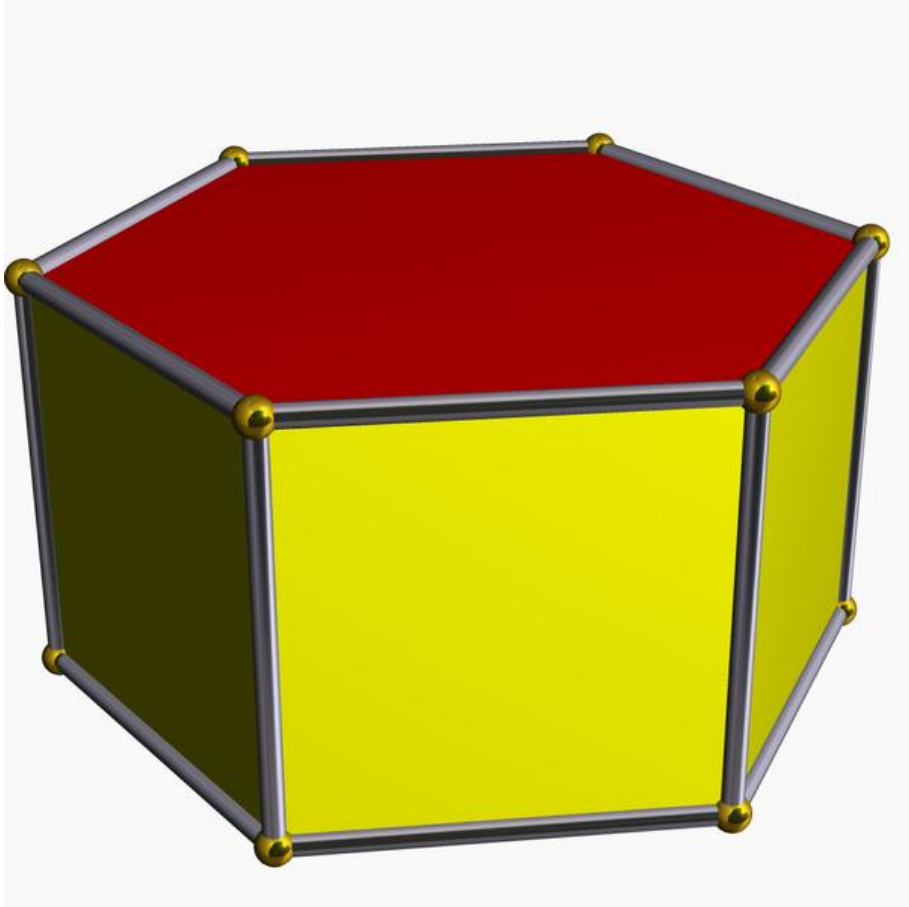


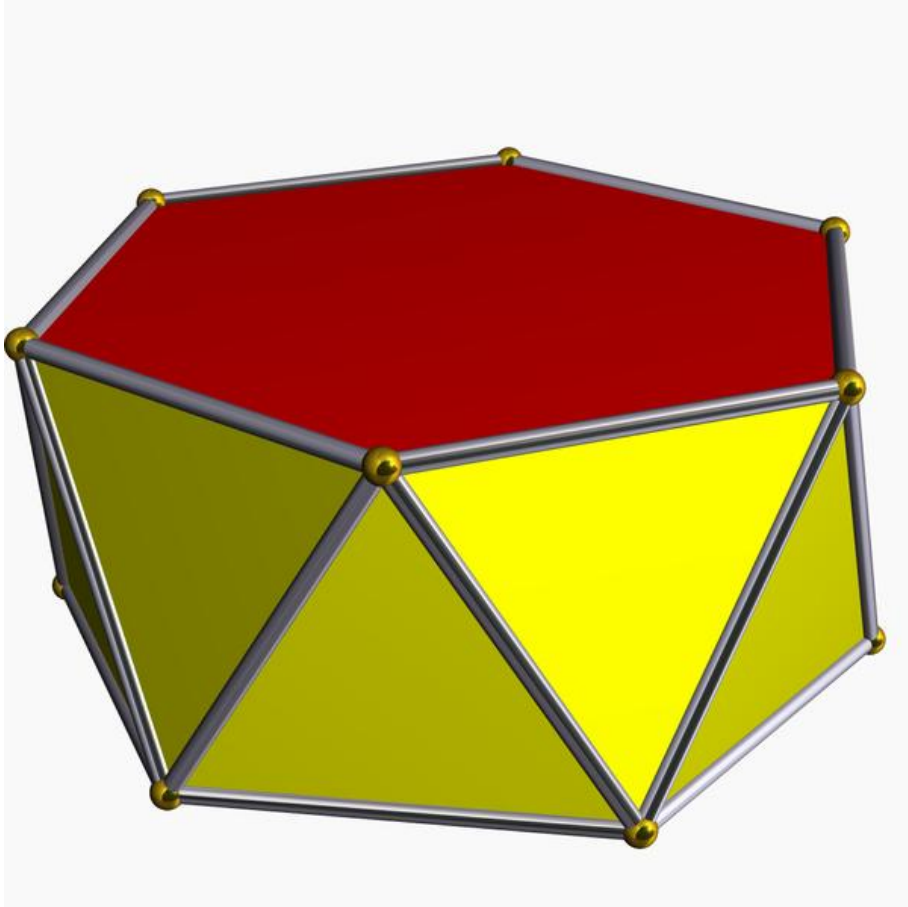
DODECAHEDRON
FLAT

ARCHIMEDEAN SOLIDS



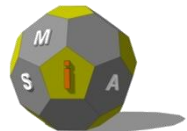
GEOMETRY





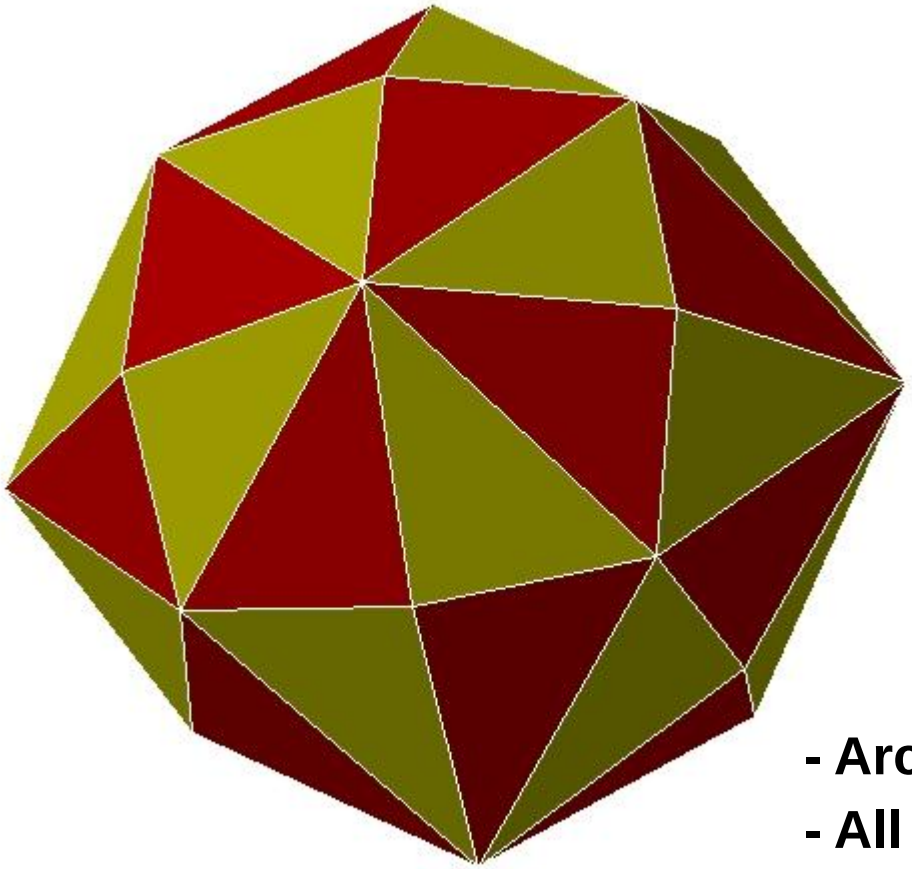
PRISMS AND ANTIPRISMS

Faces twist



GEOMETRY

Eugéne Charles Catalan - **Belgian mathematician**

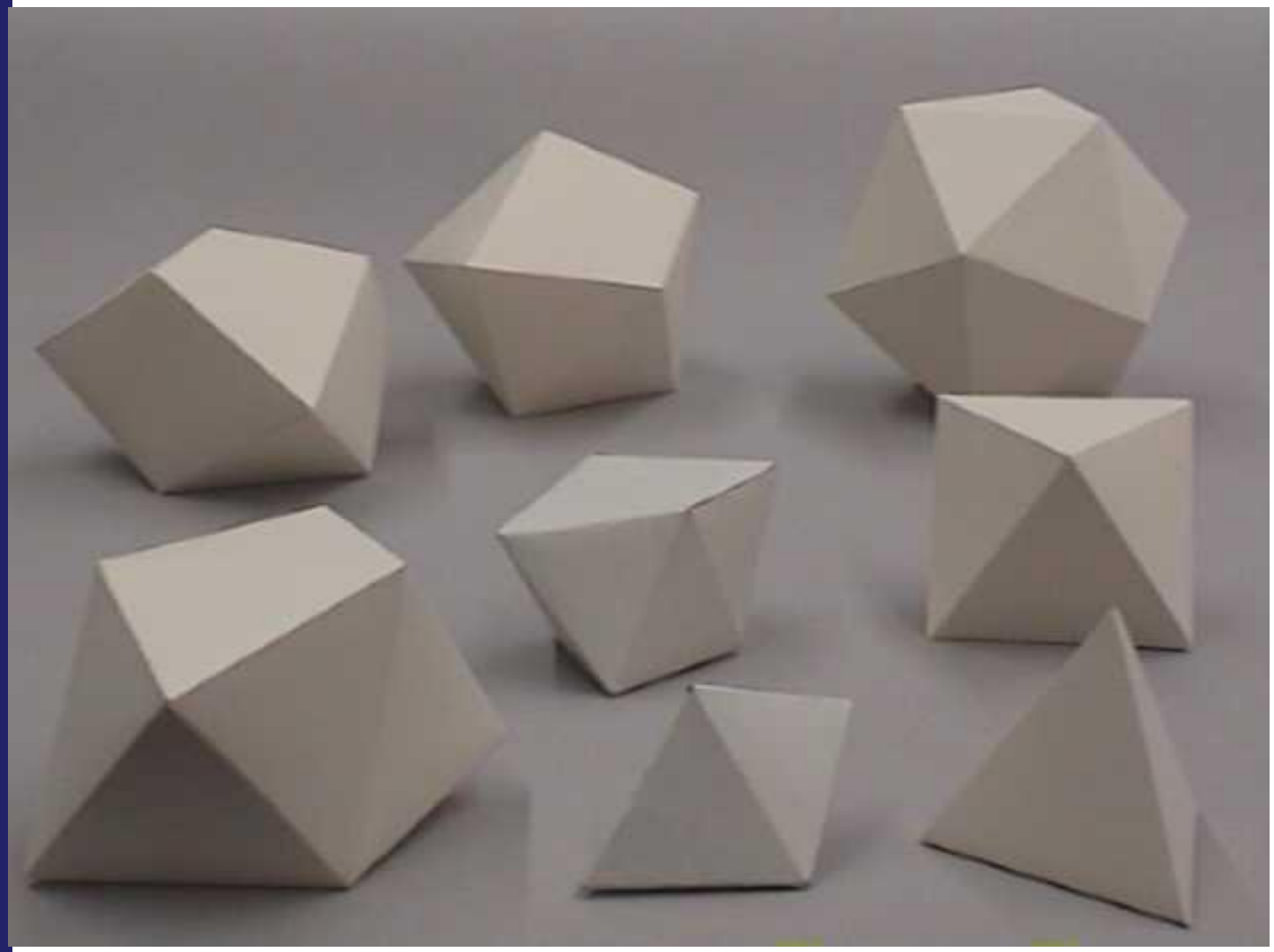


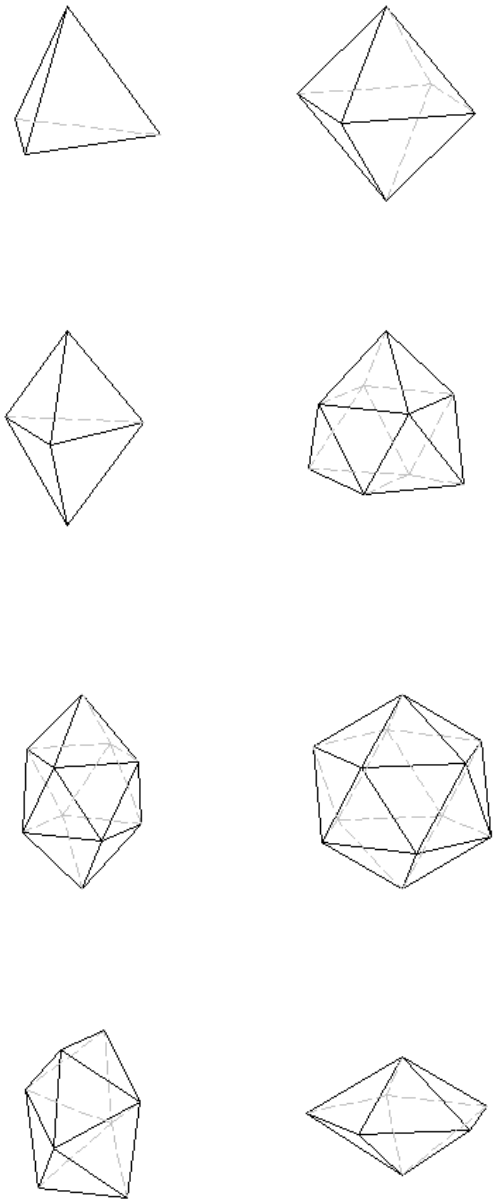
- **Archimedean** duals polyhedra.
- **All are** convex polyhedra.
- **Uniform faces but** not uniform vertices.

CATALAN SOLIDS

GEOMETRY

Norman Johnson
American mathematician

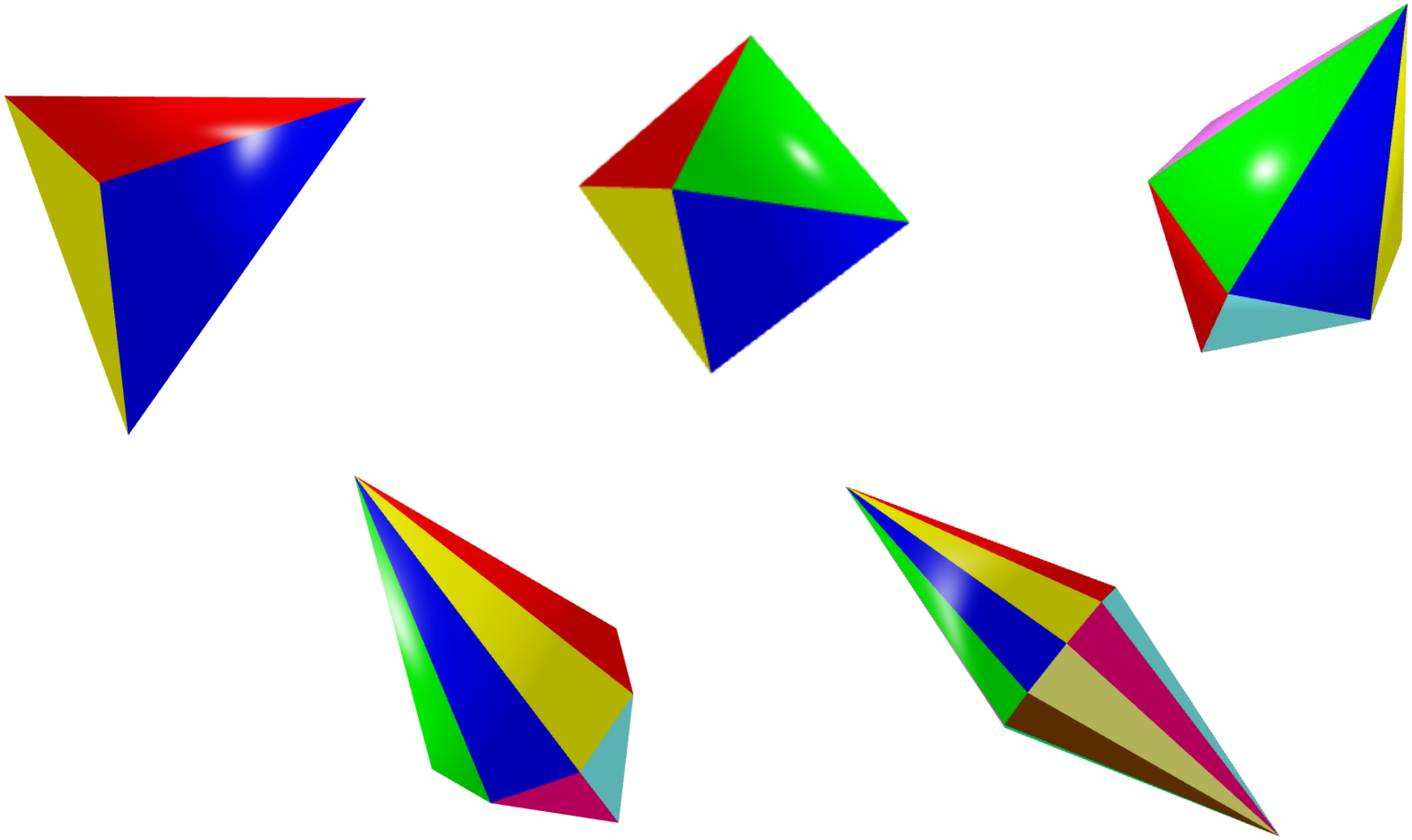




JOHNSON SOLIDS

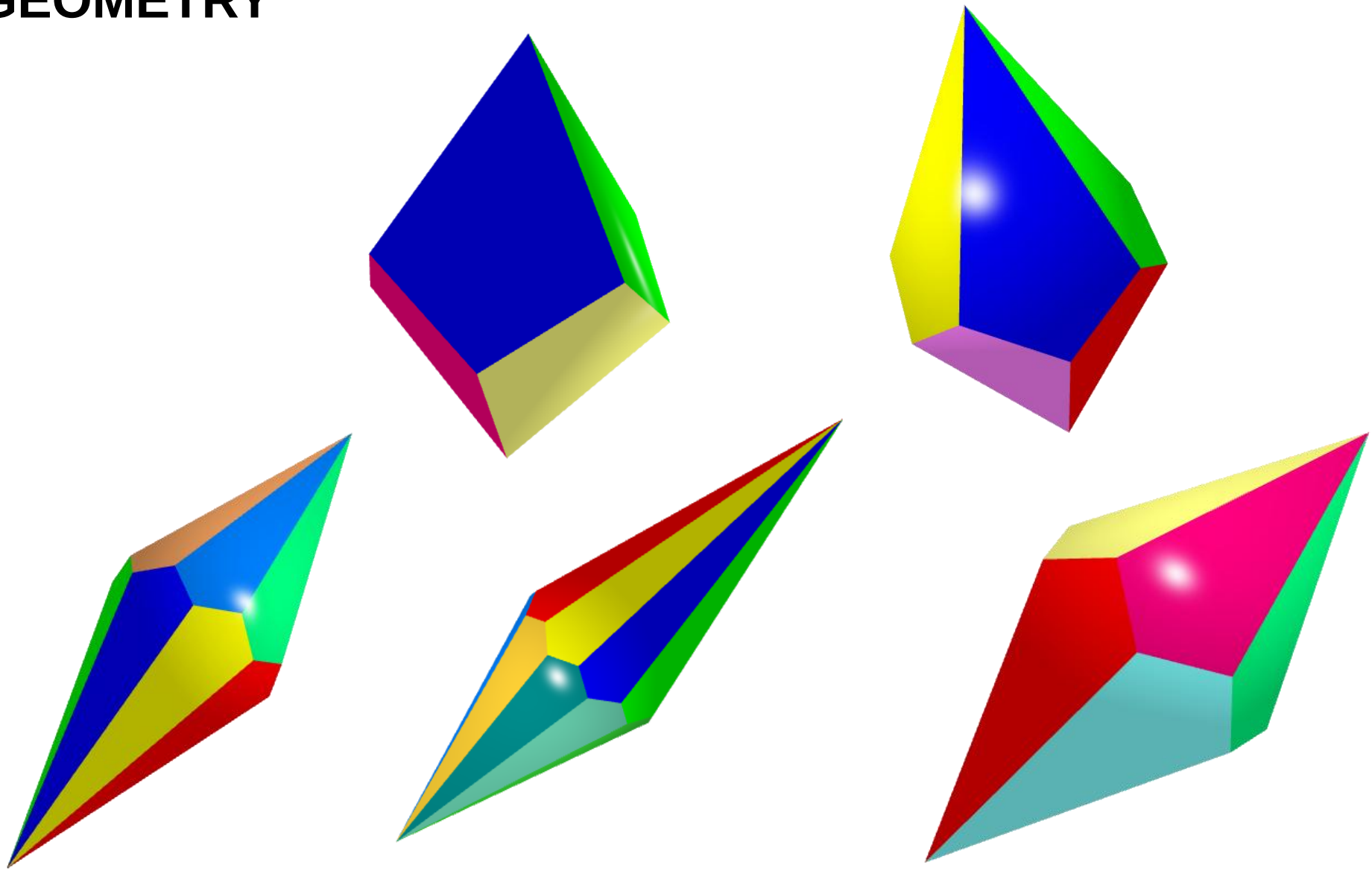
92 convex polyhedron, each face is a regular polygon.

GEOMETRY



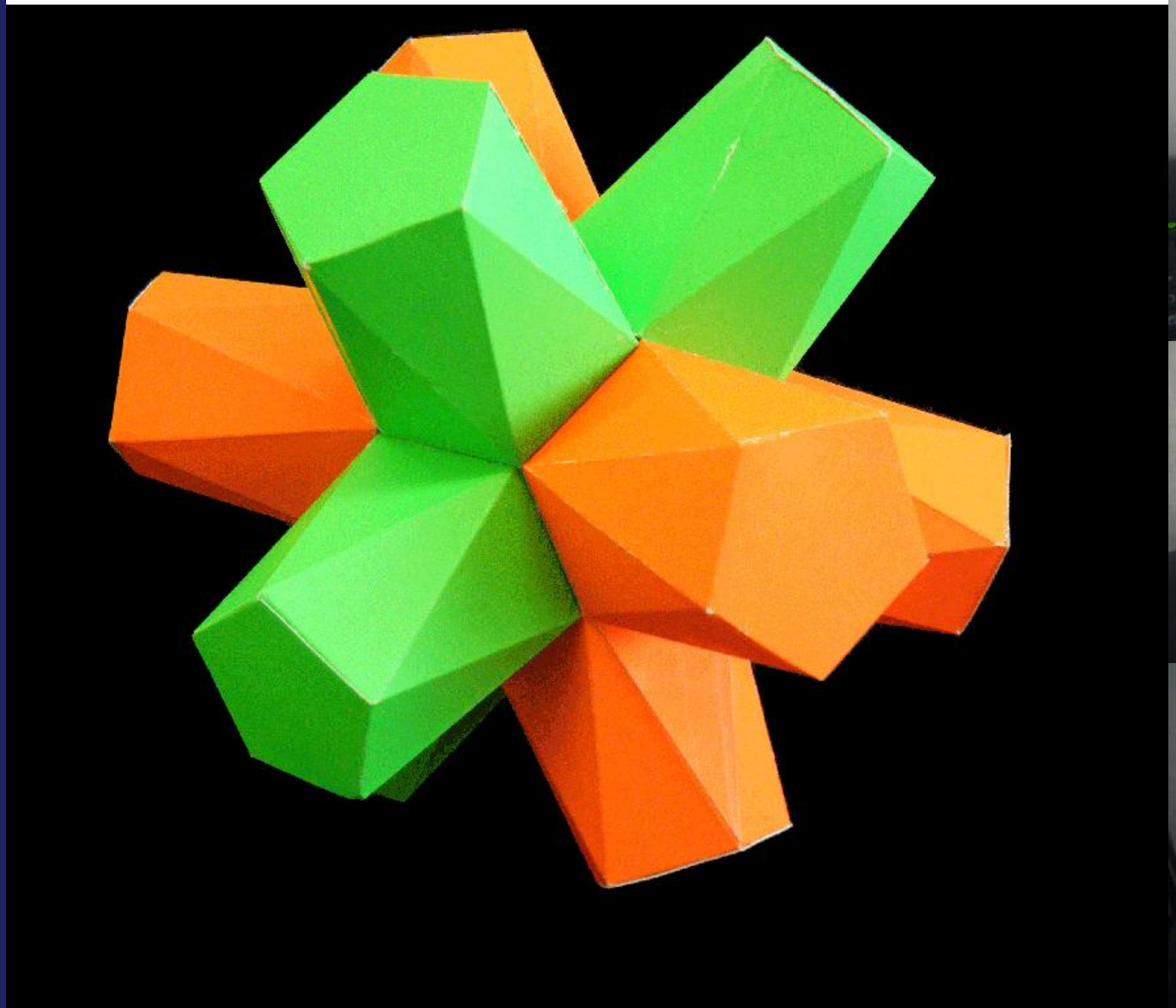
DYPIRAMIDS SOLIDS

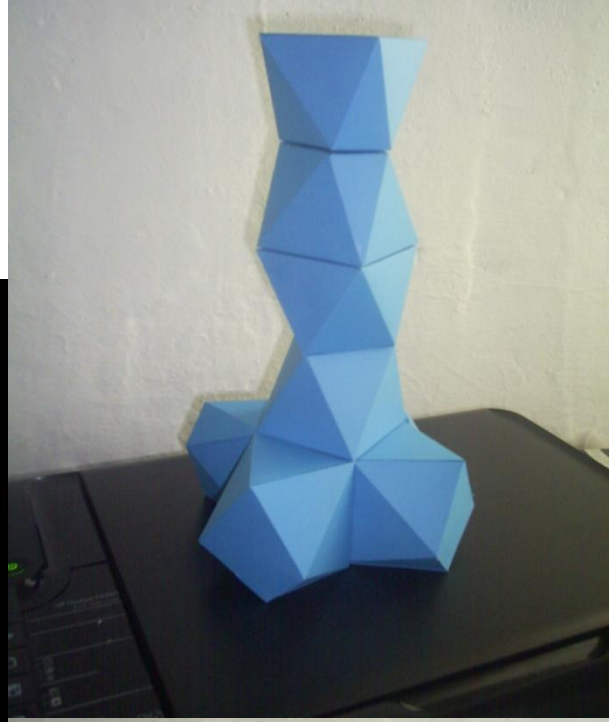
GEOMETRY



DELTOHEDRA SOLIDS

EXTRUSIONS AND GROUPINGS

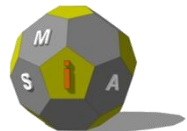


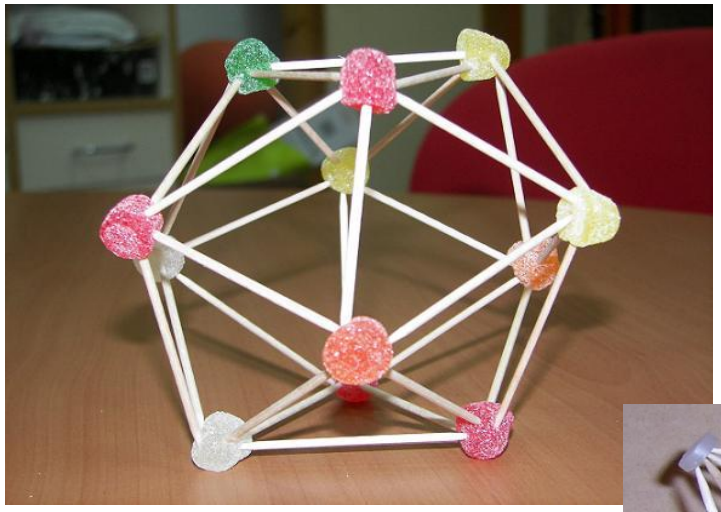


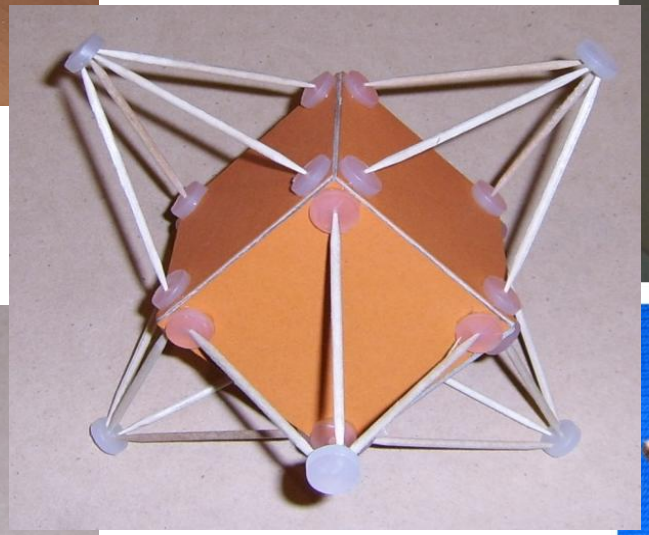
EXCERCISES

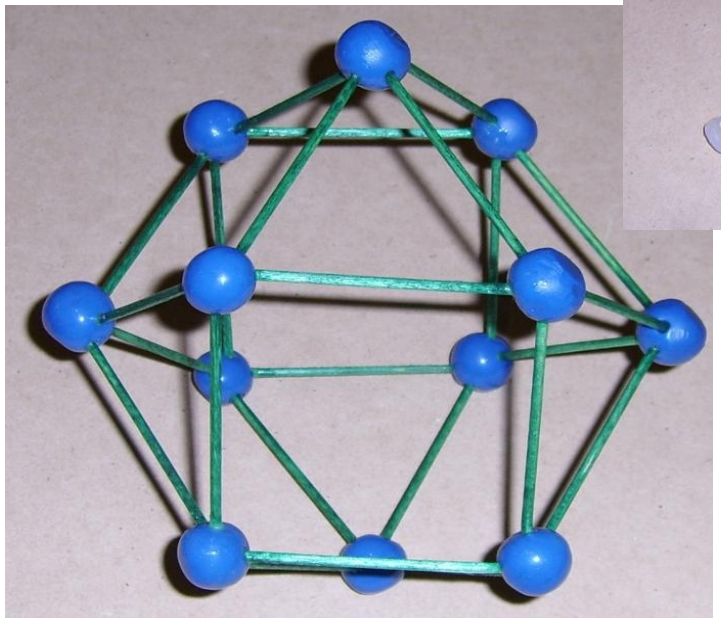
HOW?

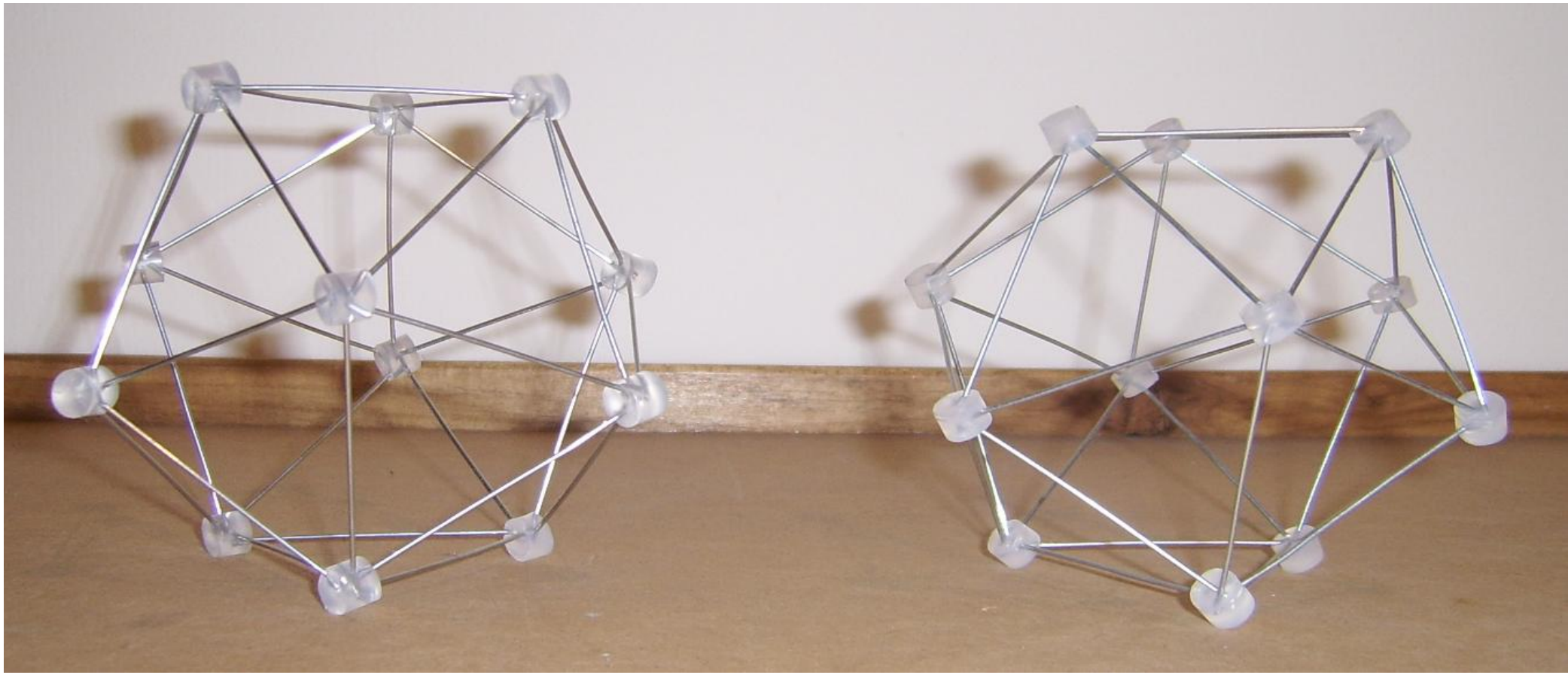
* USING MODELS
* USING SOFTWARE

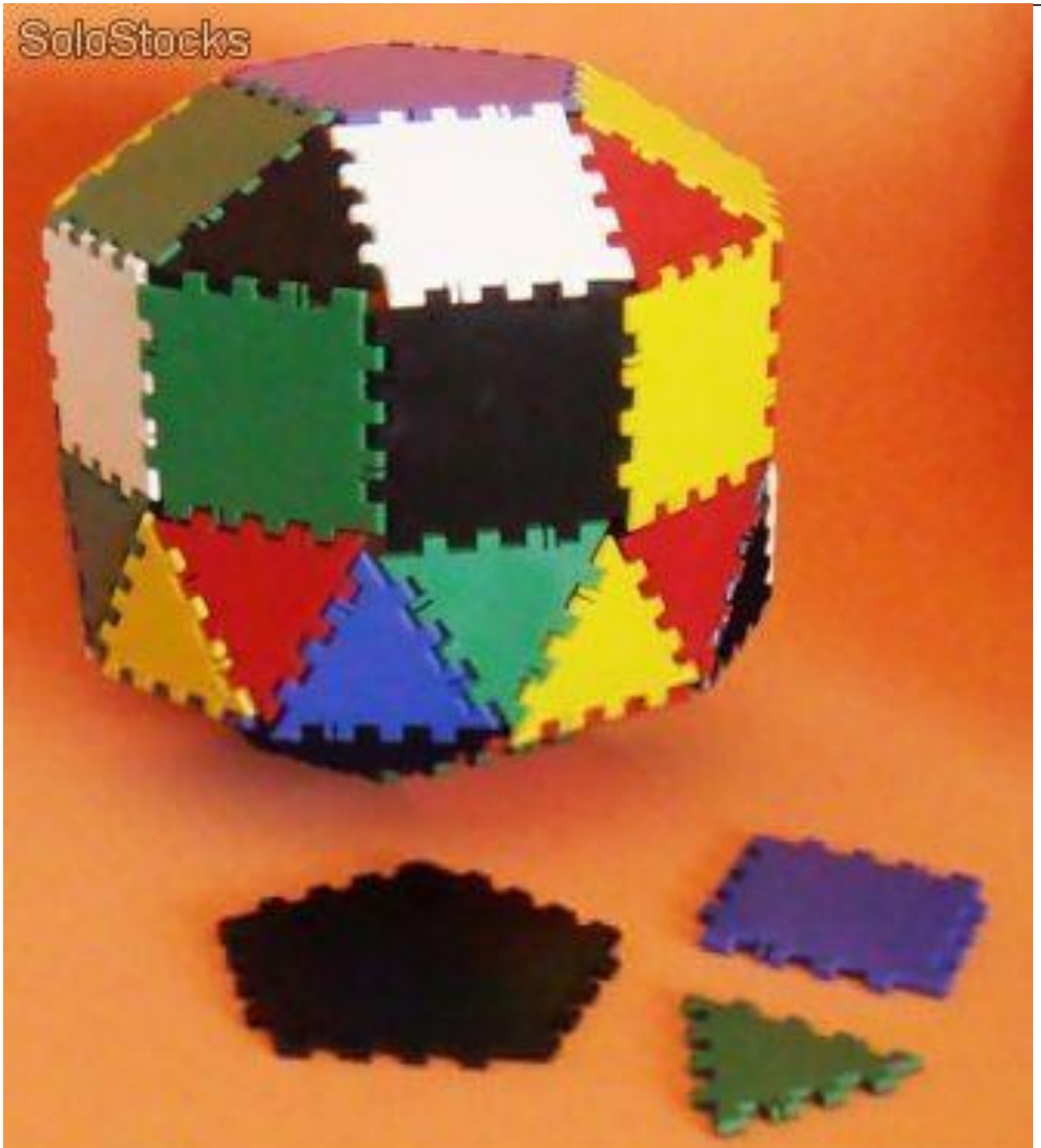


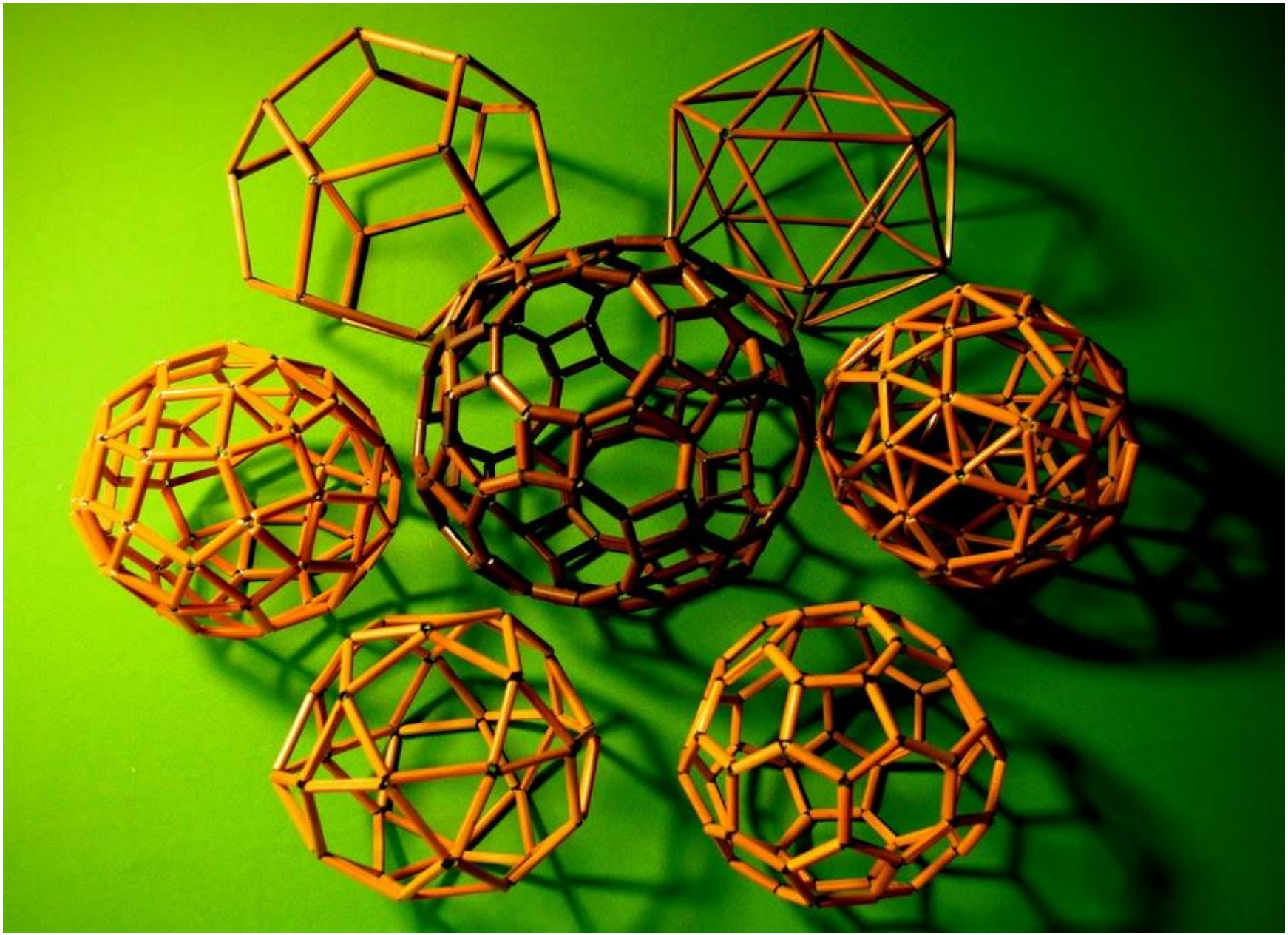






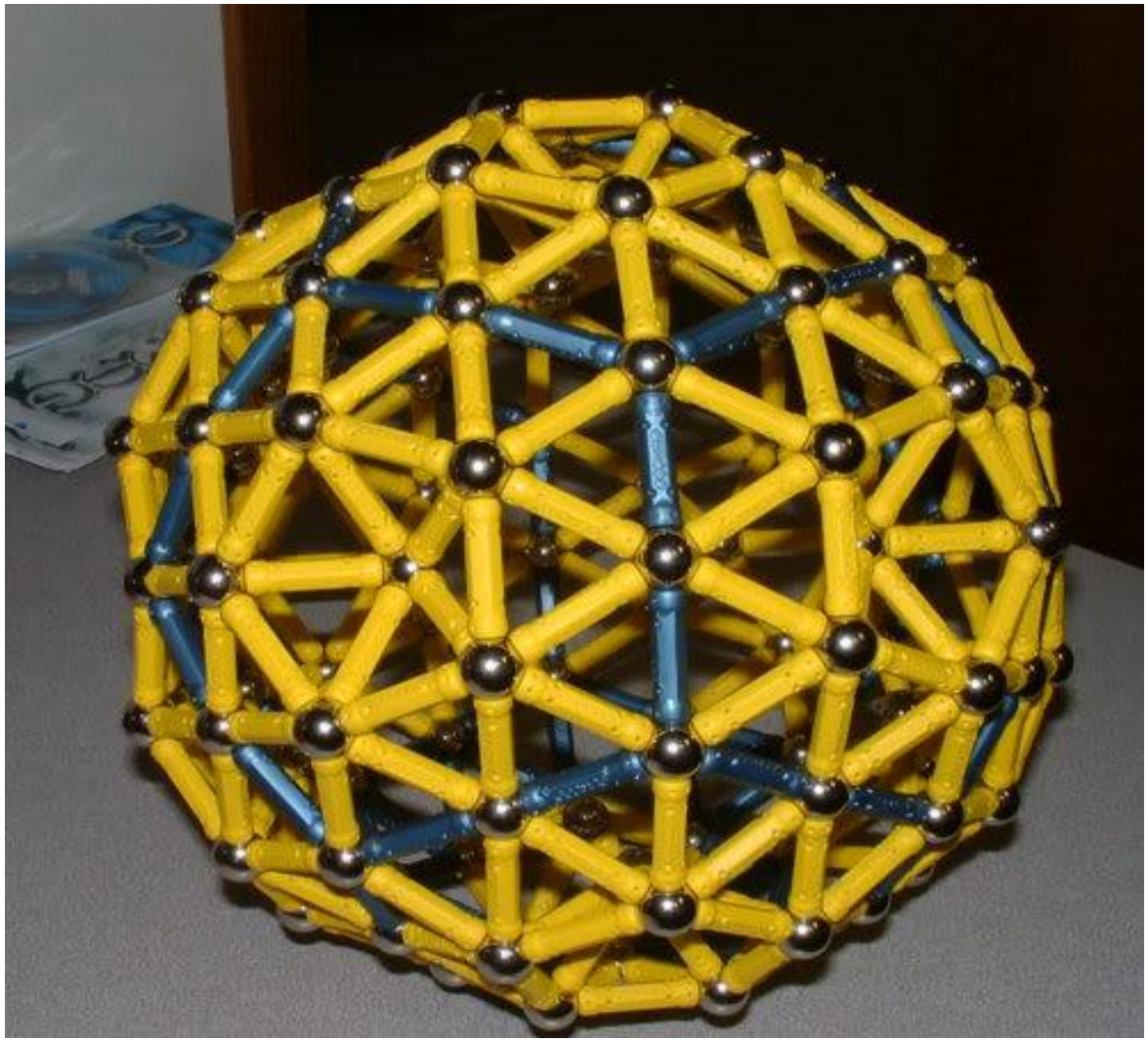



SoloStocks

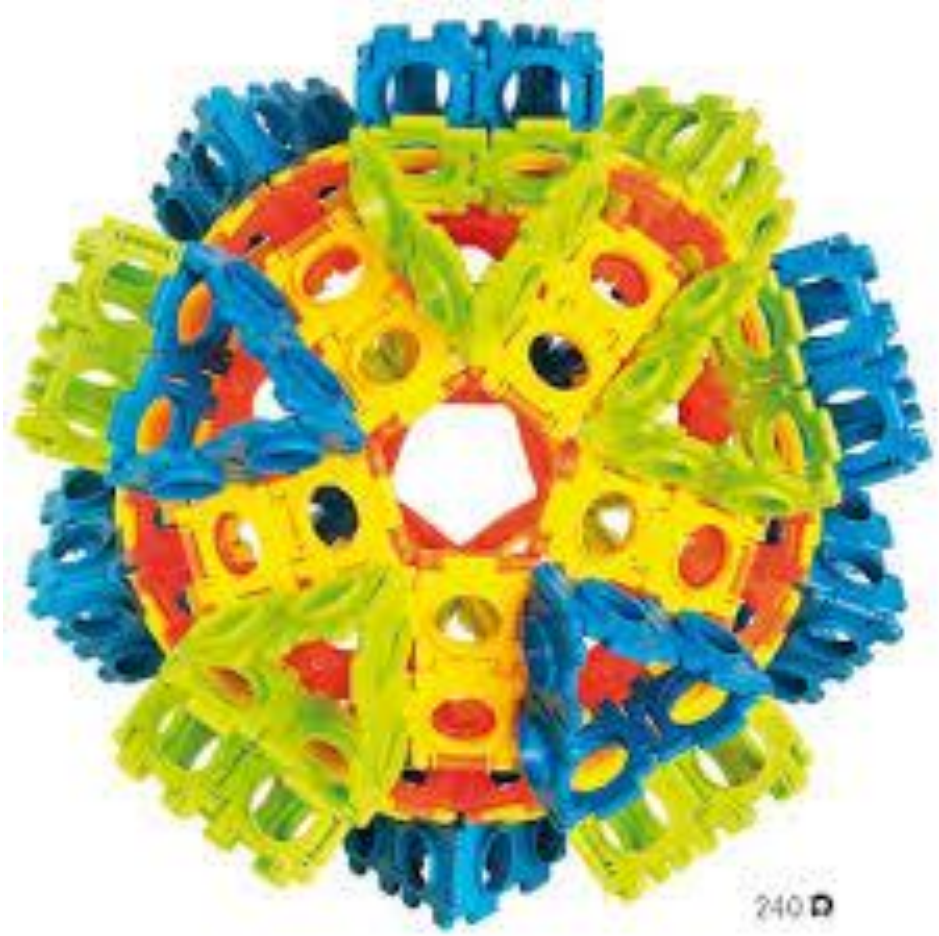


EXAMPLES WITH RECYCLING ELEMENTS

GEOMAG (magnetic toy from Switzerland)



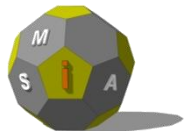
MODULMAX



SOFTWARE

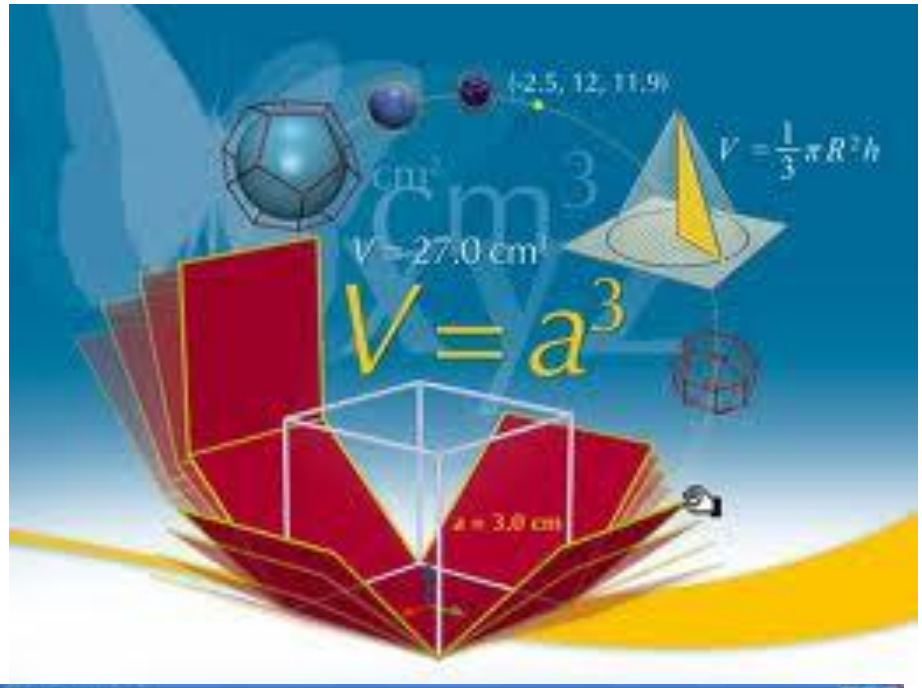
* CABRI

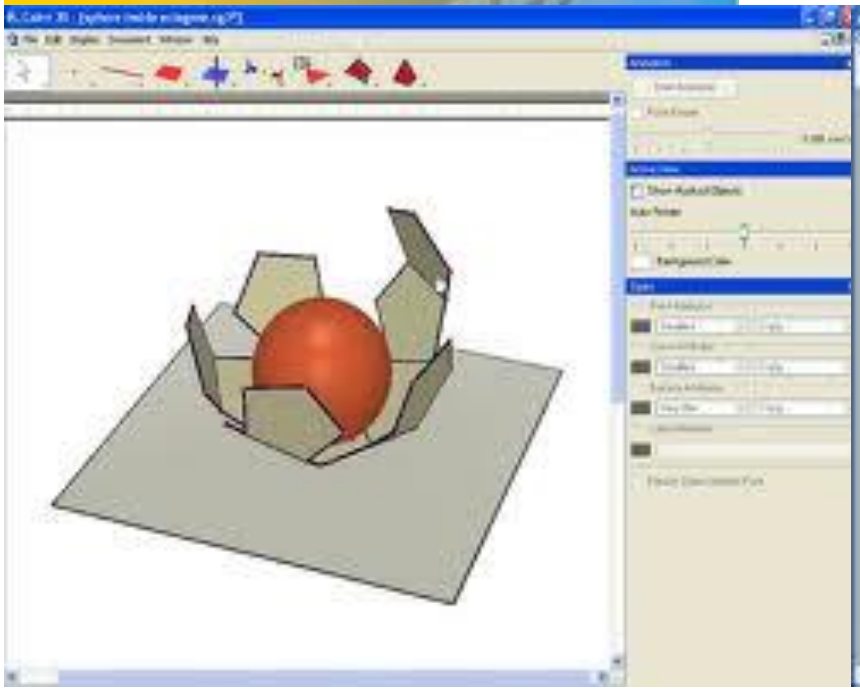
* POLY

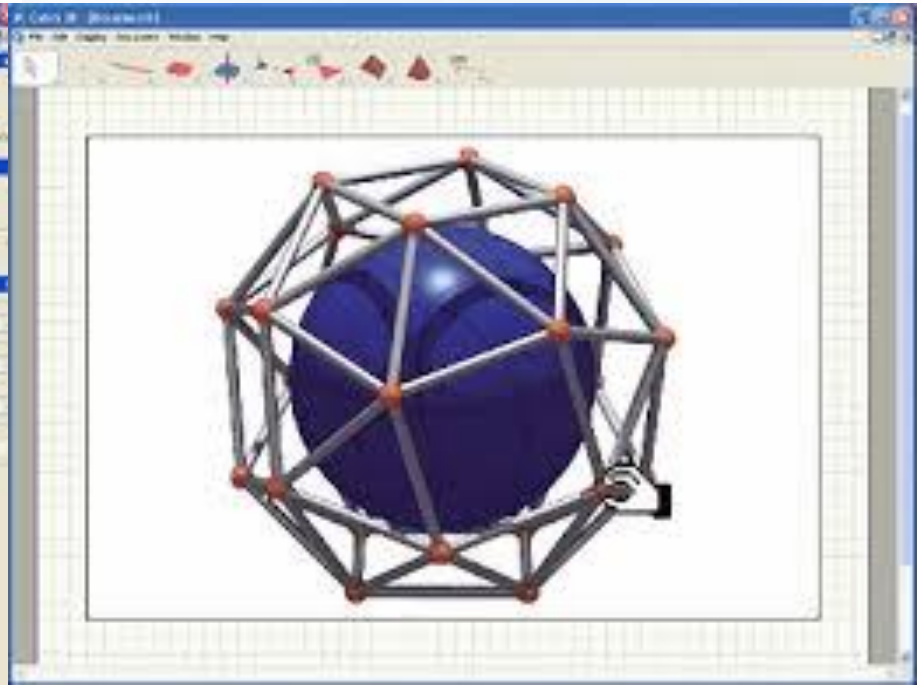


CABRI

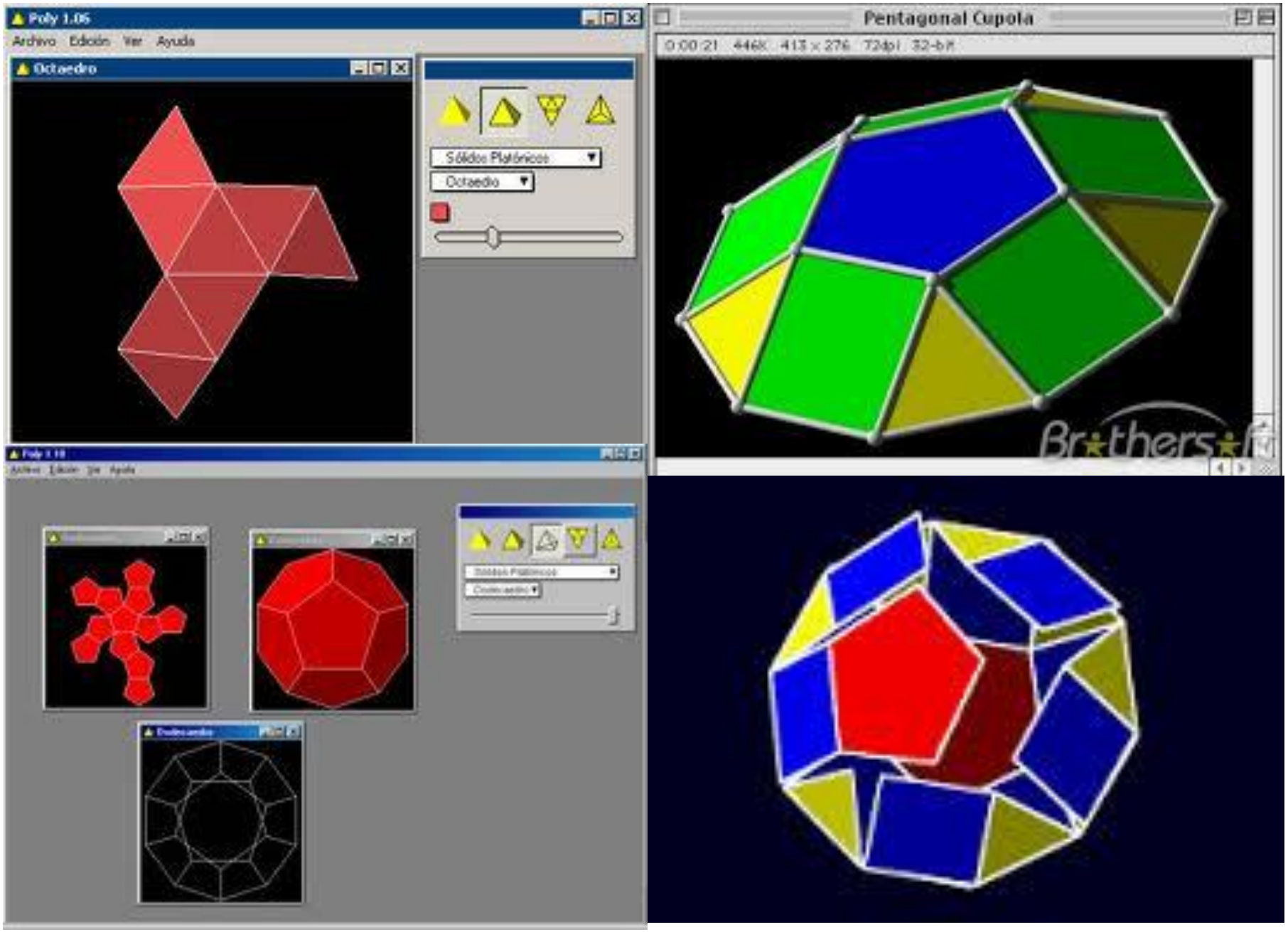

CABRI® 3D
NEW!
Explore solid geometry
with Cabri 3D!


(-2.5, 12, 11.9)
$V = \frac{1}{3}\pi R^2 h$
$V = 27.0\ \text{cm}^3$
$V = a^3$
a = 3.0 cm



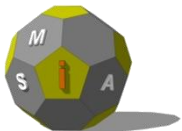


POLY


Poly 1.05
Archivo Edición Ver Ayuda
Octaedro
Sólidos Platónicos
Octaedo
Pentagonal Cupola
0:00:21 446K 413 x 276 72dpi 32-bit

LINKS

- http://en.wikipedia.org/wiki/Polyhedra
- http://www.geomagvideo.com/
- http://www.modulmax.com/
- http://www.cabri.com/download-cabri-3d.html
- http://www.peda.com/poly/
- http://www.youtube.com/watch?v=rzO1kkxlK9I (paper polyhedra)

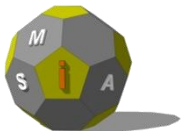


- Polygons & Solids or Polyhedra are the **geometric base** for complex structures.
- We have an important **tools**:

    - Formfinding through **physical models**.

    - Formfinding through **digital models** with different software.

CONCLUSIONS



TETRAHELIX & NETWORKS

OMAR AVELLANEDA