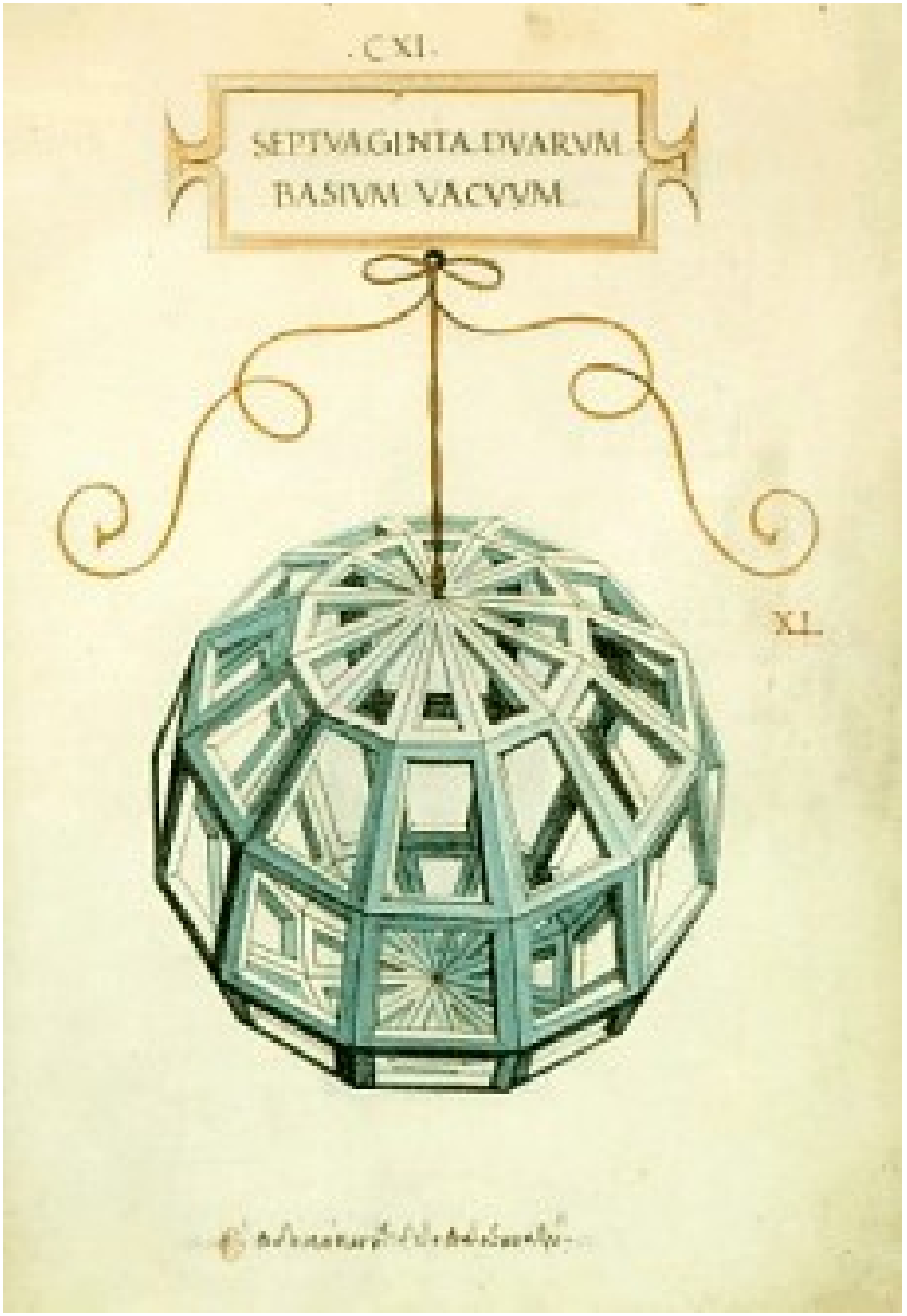
Geometry in two dimensions

- Euclidean geometry
  - Euclid (3rd Century BC)
- Spherical geometry
  - Eratosthenes (3rd Century BC)
- Hyperbolic geometry
  - Lobachevsky, Gauss (~1830)

Neolithic stone spheres (c2000BC)

Leonardo da Vinci (*The Divine Proportion, 1509)*



Spaceship Earth, 1982

Outline

- Why study non-Euclidean geometry?
- Spherical Geometry
- Spherical Tessellations
- Polyhedra

Why Study Non-Euclidean Geometry?

- M.C. Escher (Sphere with Angels and Devils, 1942)

Why Study Non-Euclidean Geometry?

- Spherical & hyperbolic tessellations.
- Polyhedra and Platonic solids.
- Good source of student artwork ideas.
- Beautiful classification of regular tessellations.
- Possible influence on Cubism (early 1900's).

Spherical Geometry

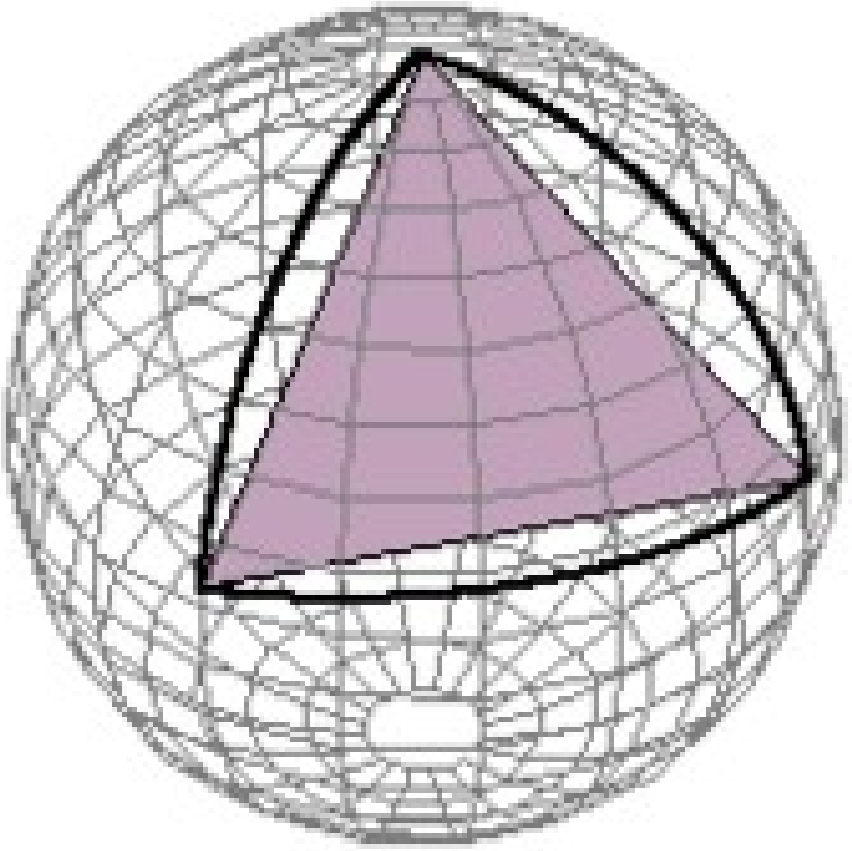
- Geometry on the surface of a sphere.
- “Geo-metry”: measuring the Earth
- Geometry requires points and lines. What are the lines?

Geodesics

- Geodesics play the role of “straight lines”
  - Look straight to an observer on the surface of the sphere
  - Shortest distance paths
- Spherical geodesics are great circles.

Triangles

- Made of three geodesic segments.
- Have angle sum > 180°. They “bulge”.



Defect and area

- The defect of a triangle is the amount it's angle sum differs from 180°.
- The defect of any polygon is the amount it's angle sum differs from the angle sum of a Euclidean polygon with the same number of sides.
- Defect / 720° = Fraction of Sphere Covered.

Modalities

- 2D projected drawing
- Drawing on a sphere
- Using software