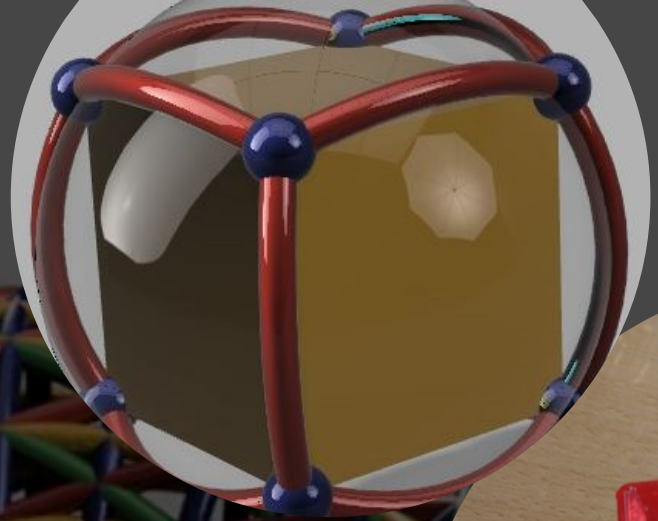
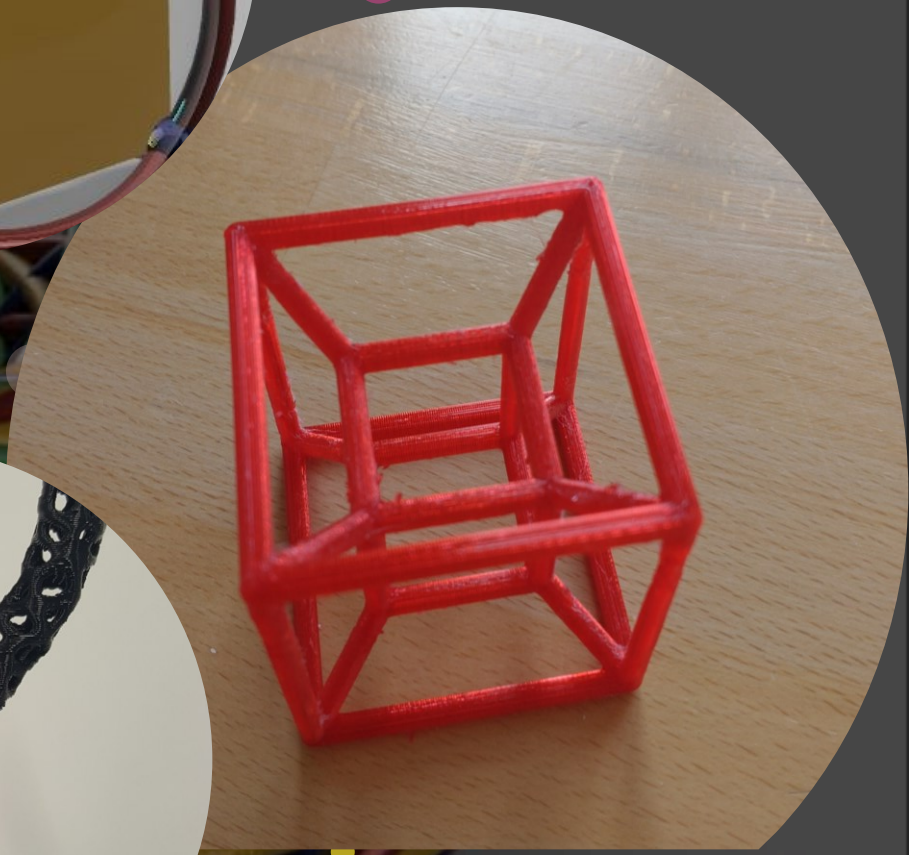
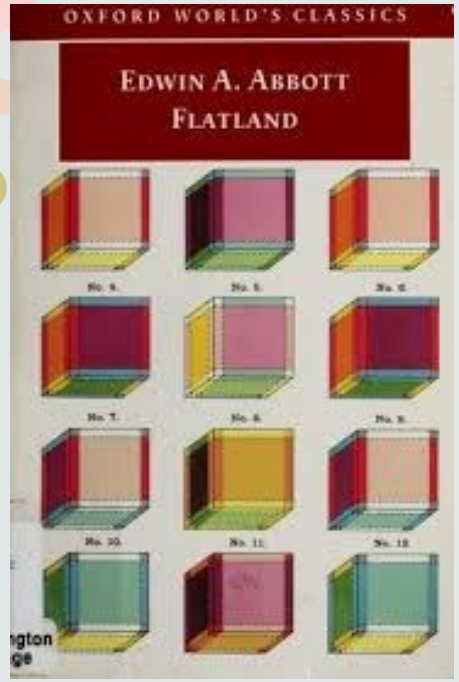
Geometrische Reise in die vierte Dimension

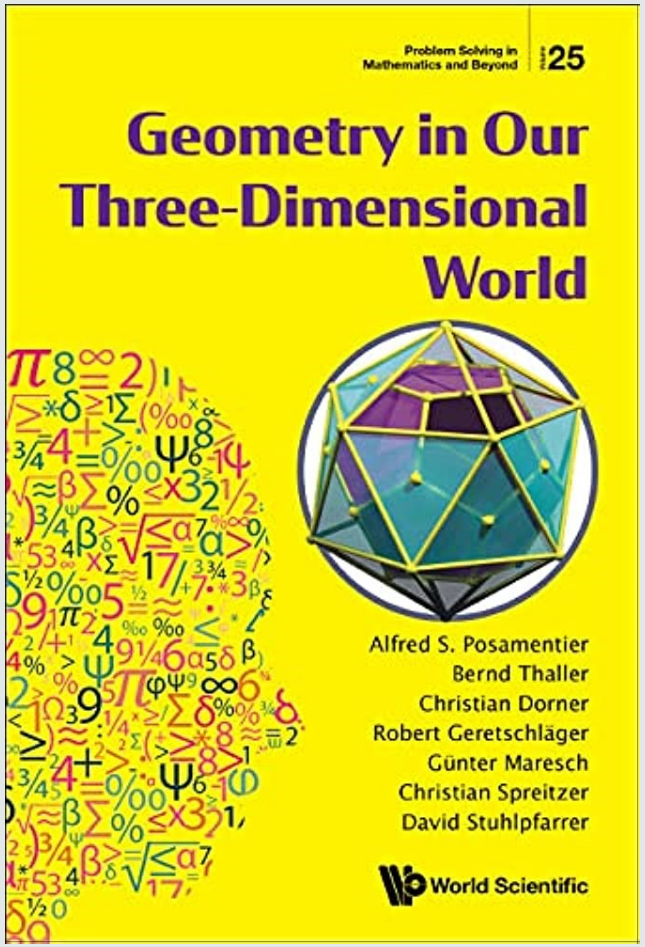
David Stuhlpfarrer



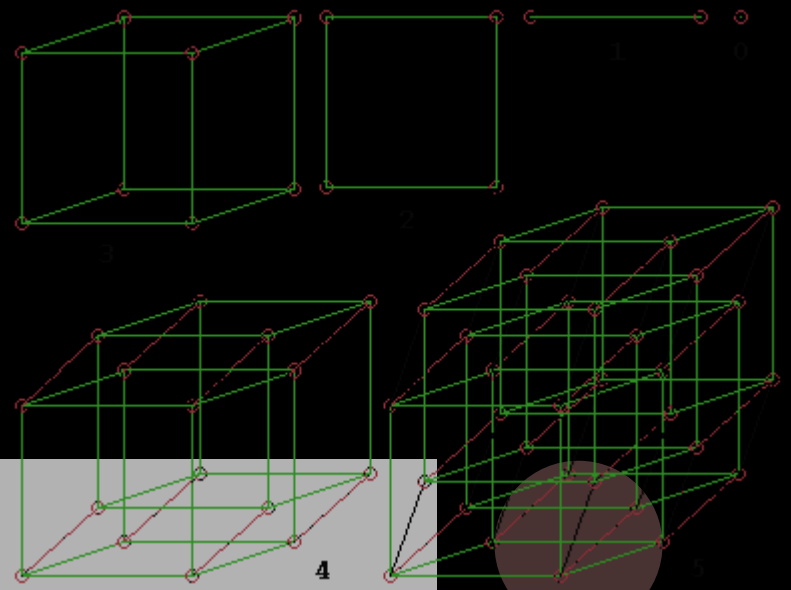


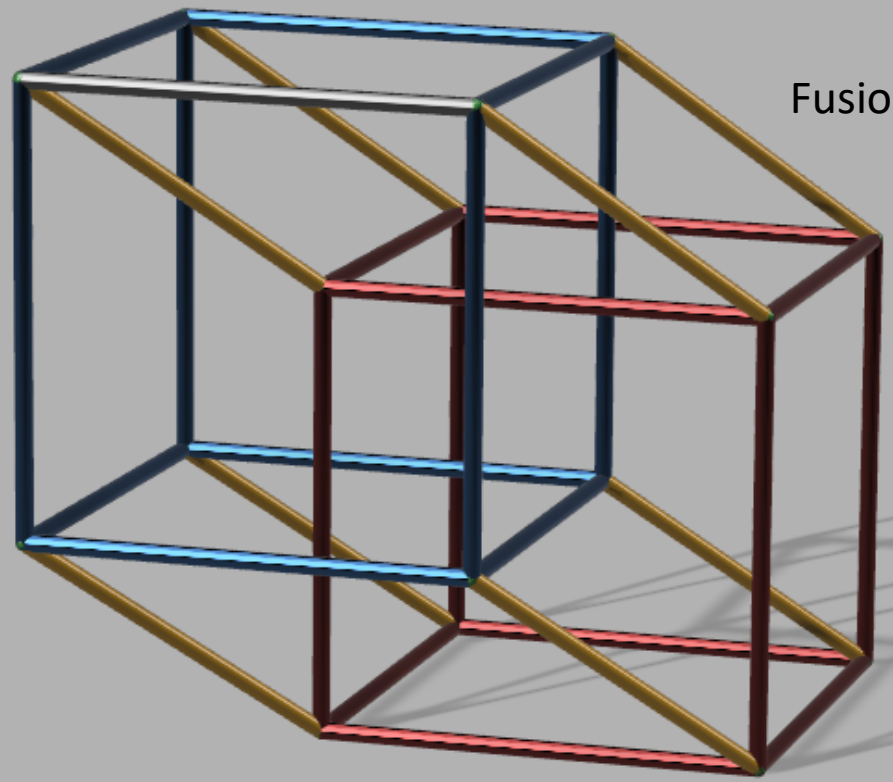
Literaturempfehlungen





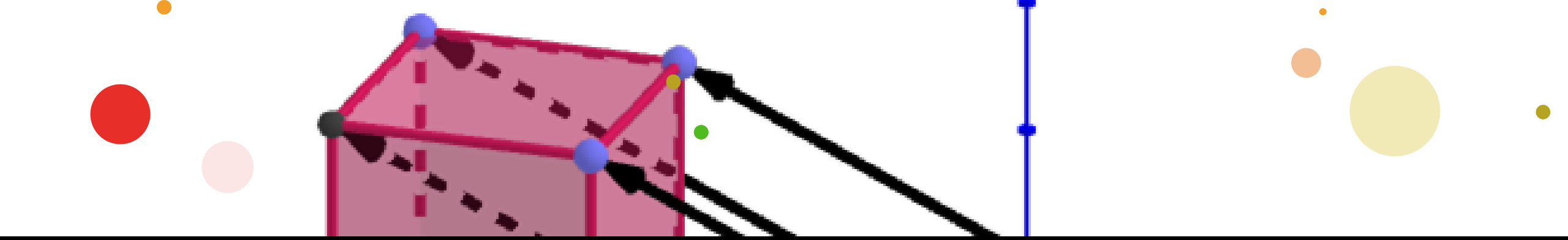
Idee: „Herausziehen“





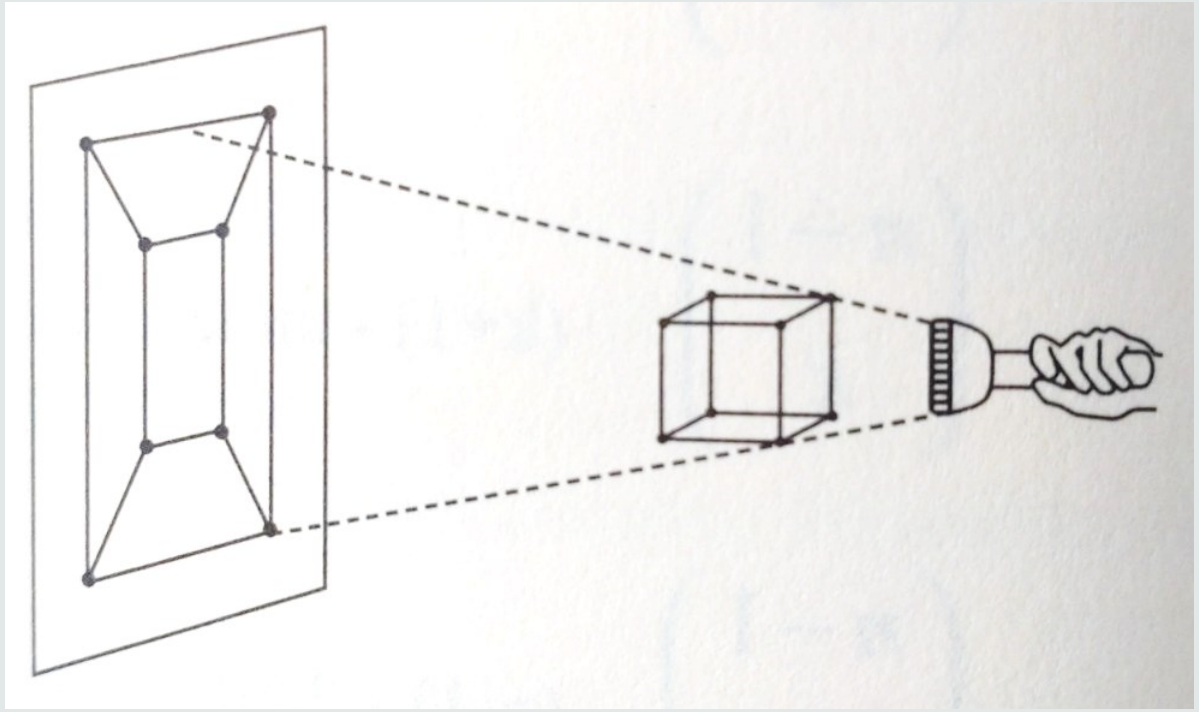
Fusion360

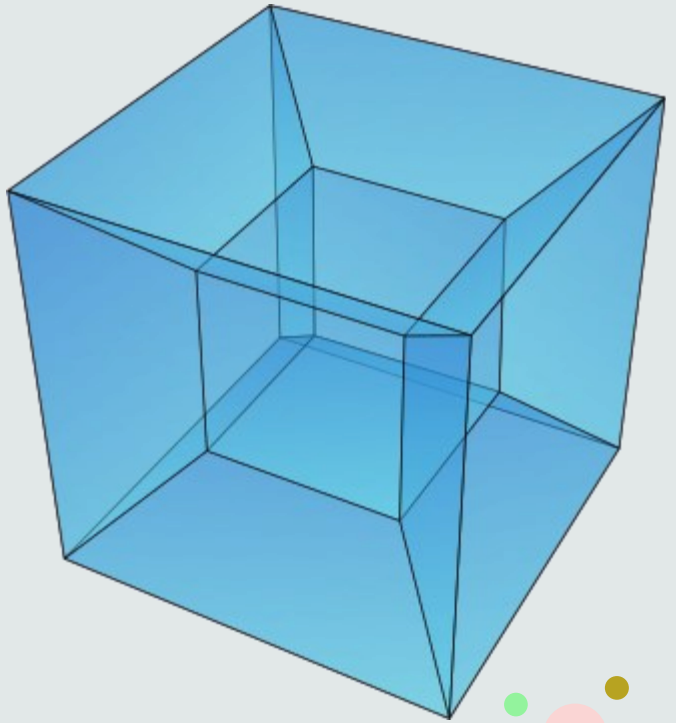
http://www.mathematische-basteleien.de/hyperkubus.htm

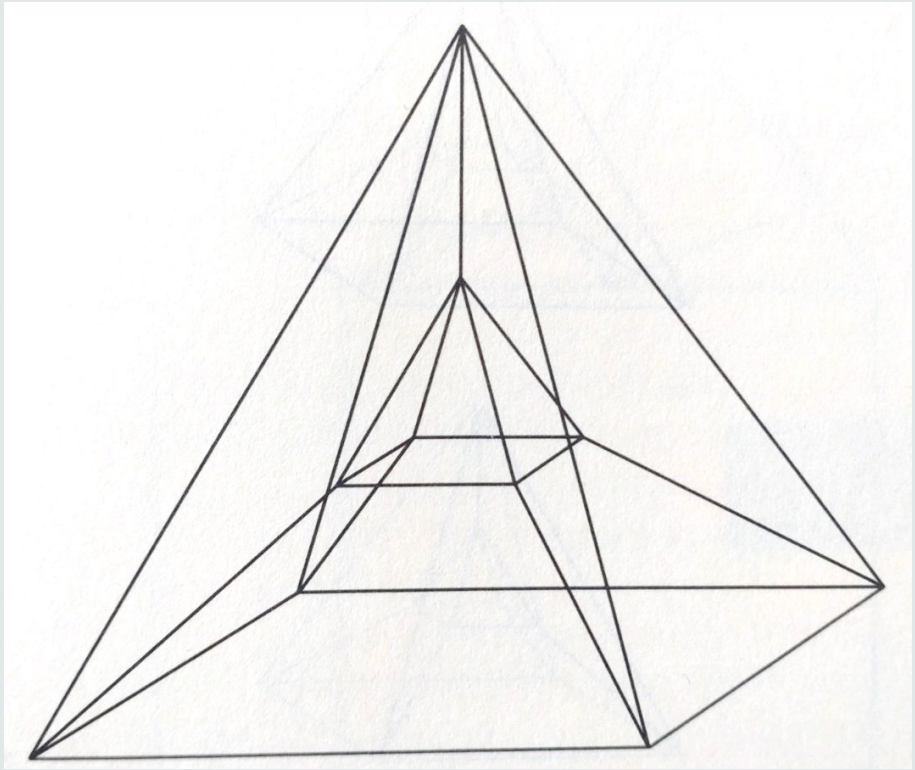


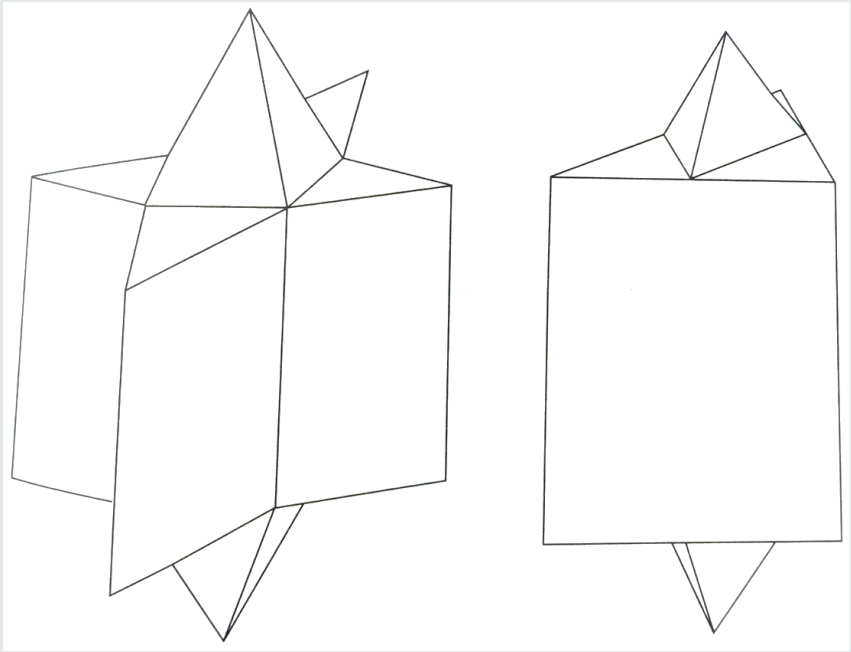
GeoGebra

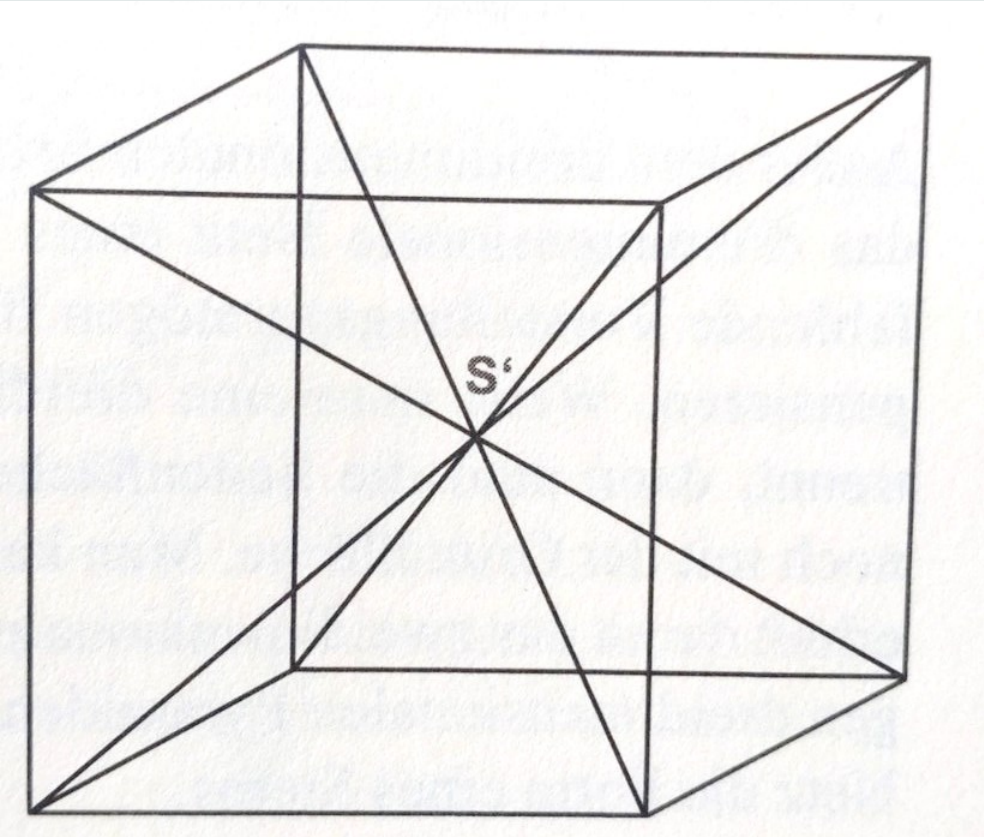
Schlegeldiagramm

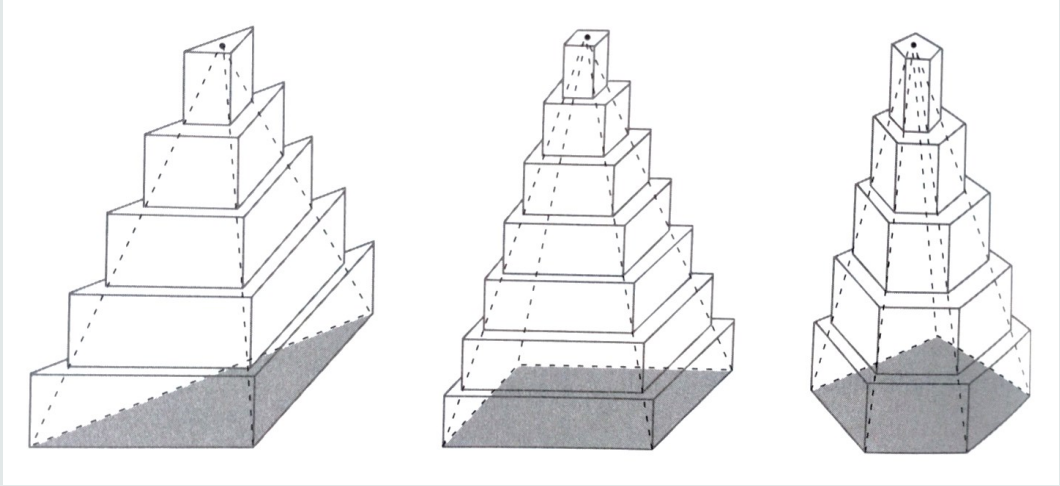


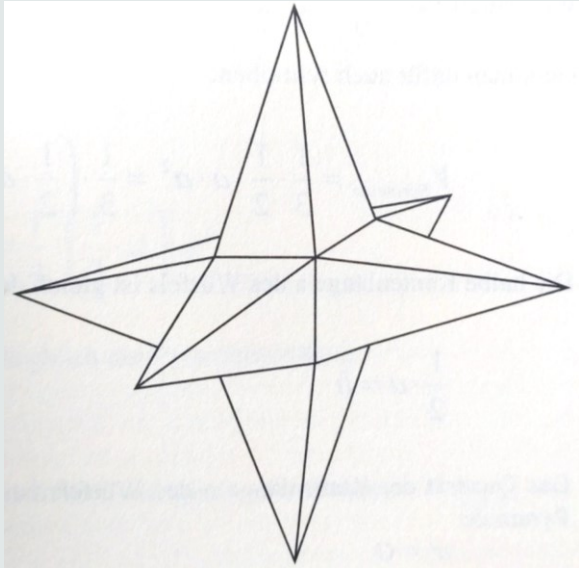




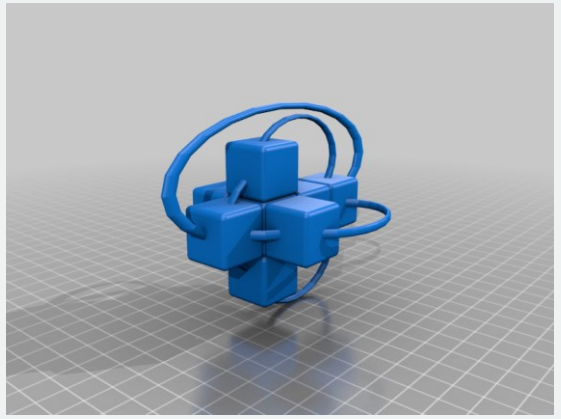


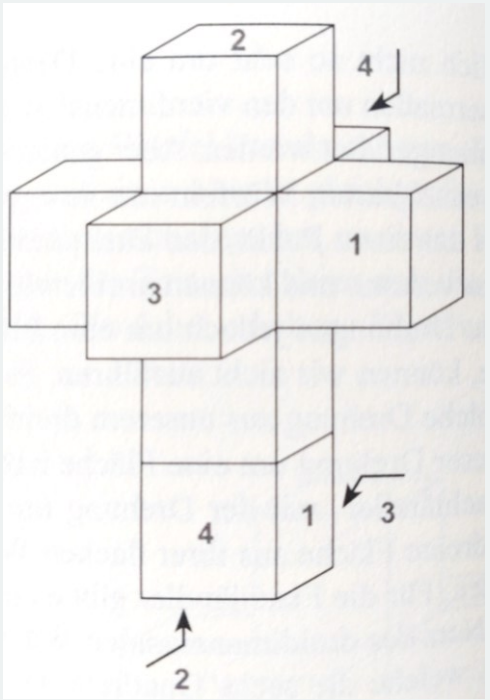




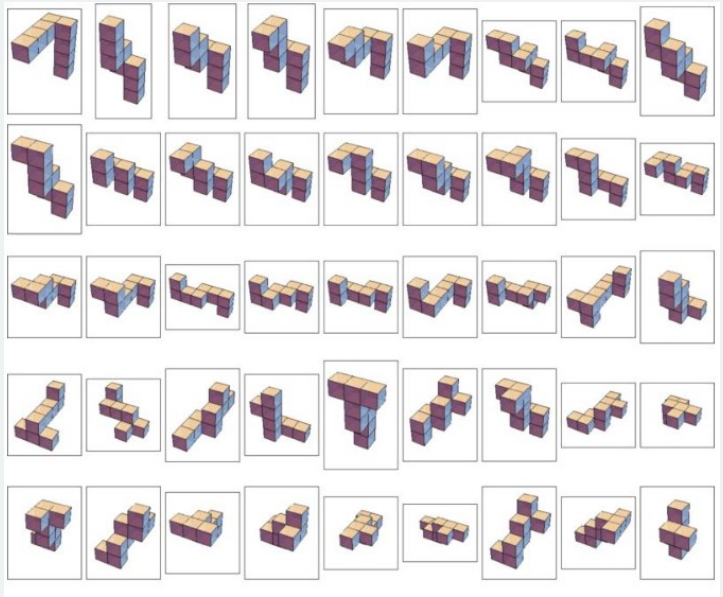


$$V_{4\,Pyramide} = \frac{1}{4} \cdot V_{Grundkörper} \cdot h$$



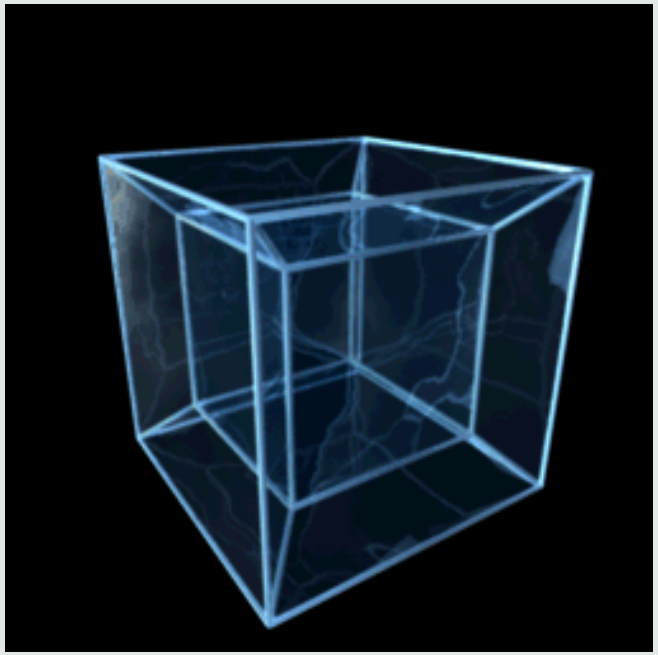


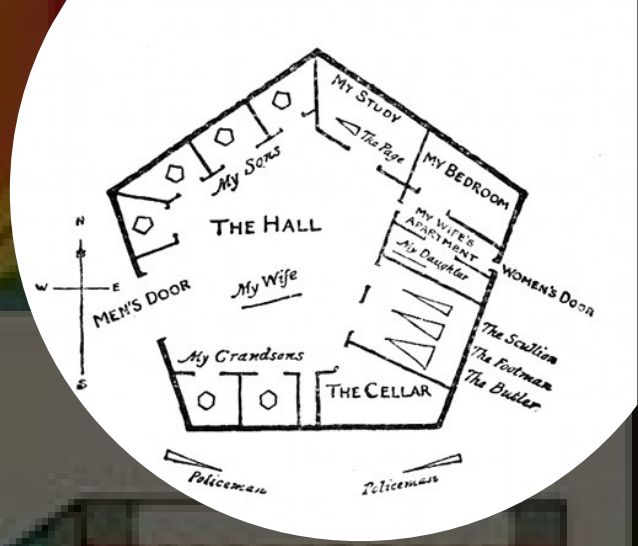
Abwicklung



https://unfolding.apperceptual.com/ https://papier.schulkreis.de/wuerfelnetz

Projektion eines Hyperwürfels (und rotierend)





No. 7.

No. 8.

Flatland

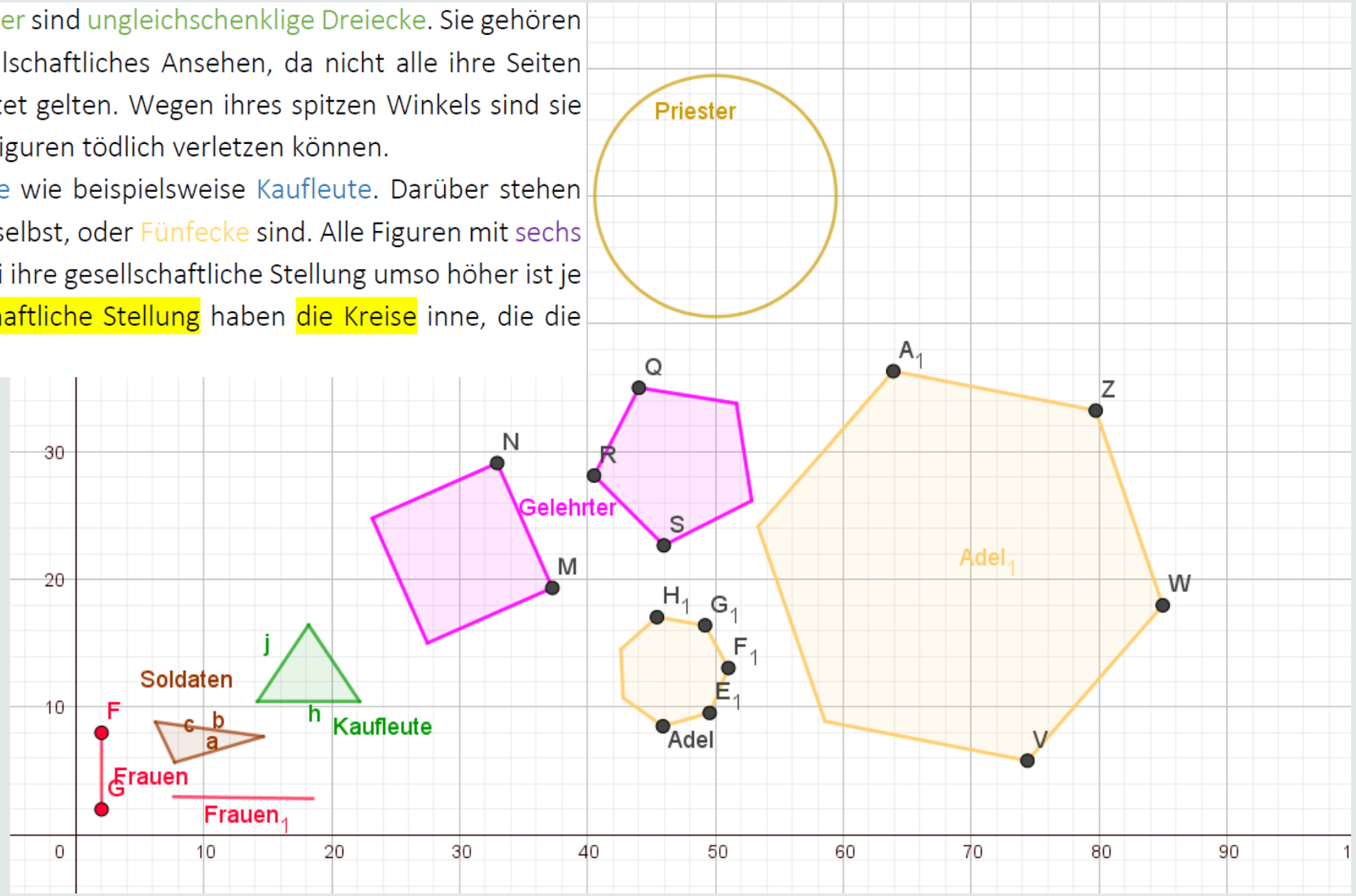
No. 10.

No. 11.

No. 12

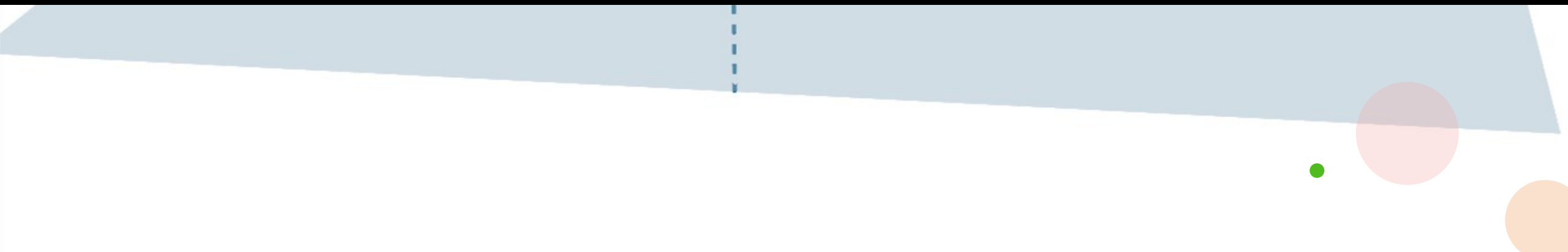
Bewohner_innen

Frauen sind gerade Linien. Soldaten und Arbeiter sind ungleichschenklige Dreiecke. Sie gehören der Unterschicht an und genießen kein gesellschaftliches Ansehen, da nicht alle ihre Seiten gleich lang sind und sie deshalb als verunstaltet gelten. Wegen ihres spitzen Winkels sind sie jedoch gefährlich, da sie damit leicht andere Figuren tödlich verletzen können.
Die Mittelschicht bilden gleichseitige Dreiecke wie beispielsweise Kaufleute. Darüber stehen die Gelehrten, die Quadrate, wie der Erzähler selbst, oder Fünfecke sind. Alle Figuren mit sechs oder mehr Seiten gehören dem Adel an, wobei ihre gesellschaftliche Stellung umso höher ist je mehr Seiten sie haben. Die höchste gesellschaftliche Stellung haben die Kreise inne, die die Priesterkaste bilden.

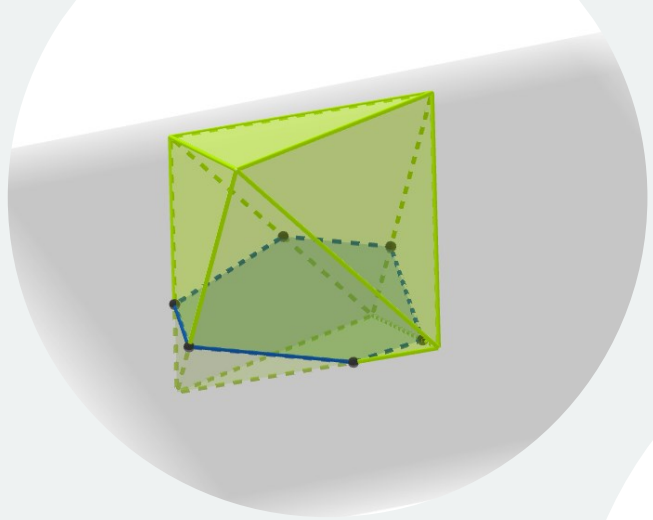


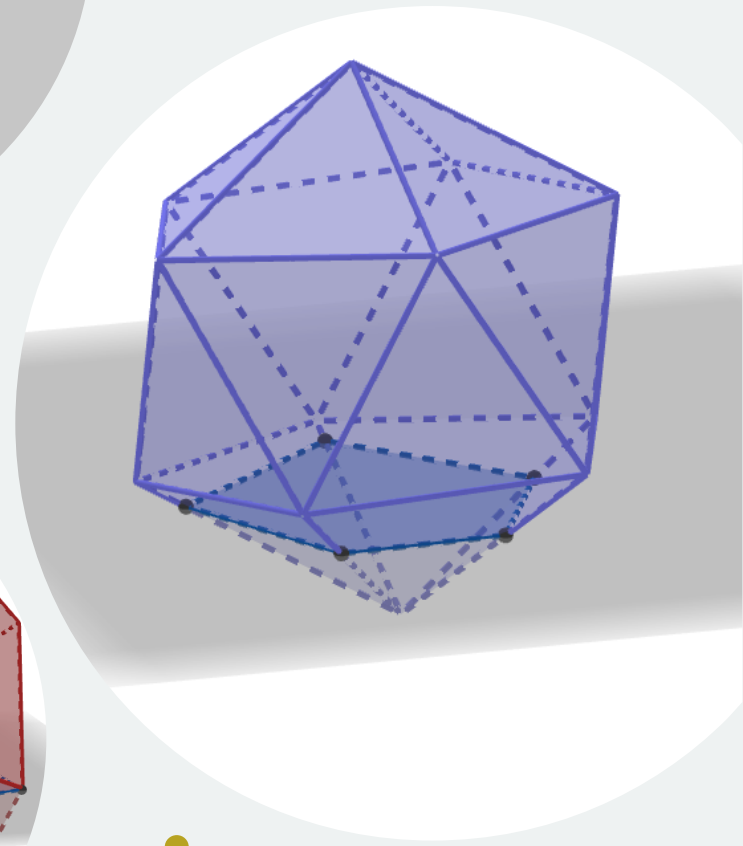
Besuch der Kugel

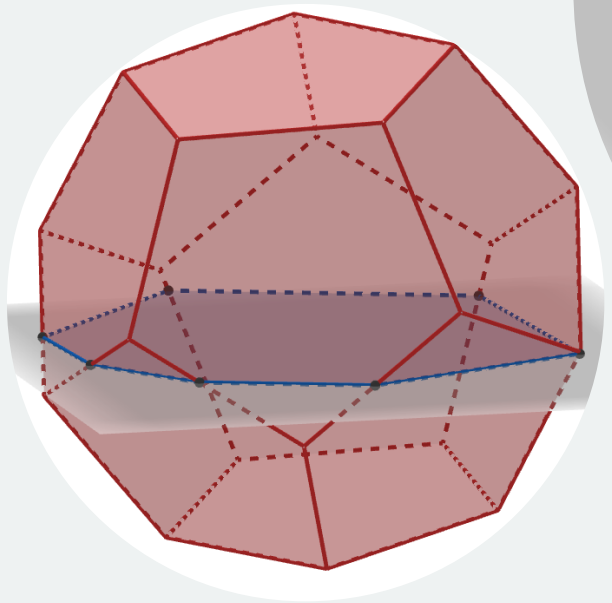
Besuch eines Würfels



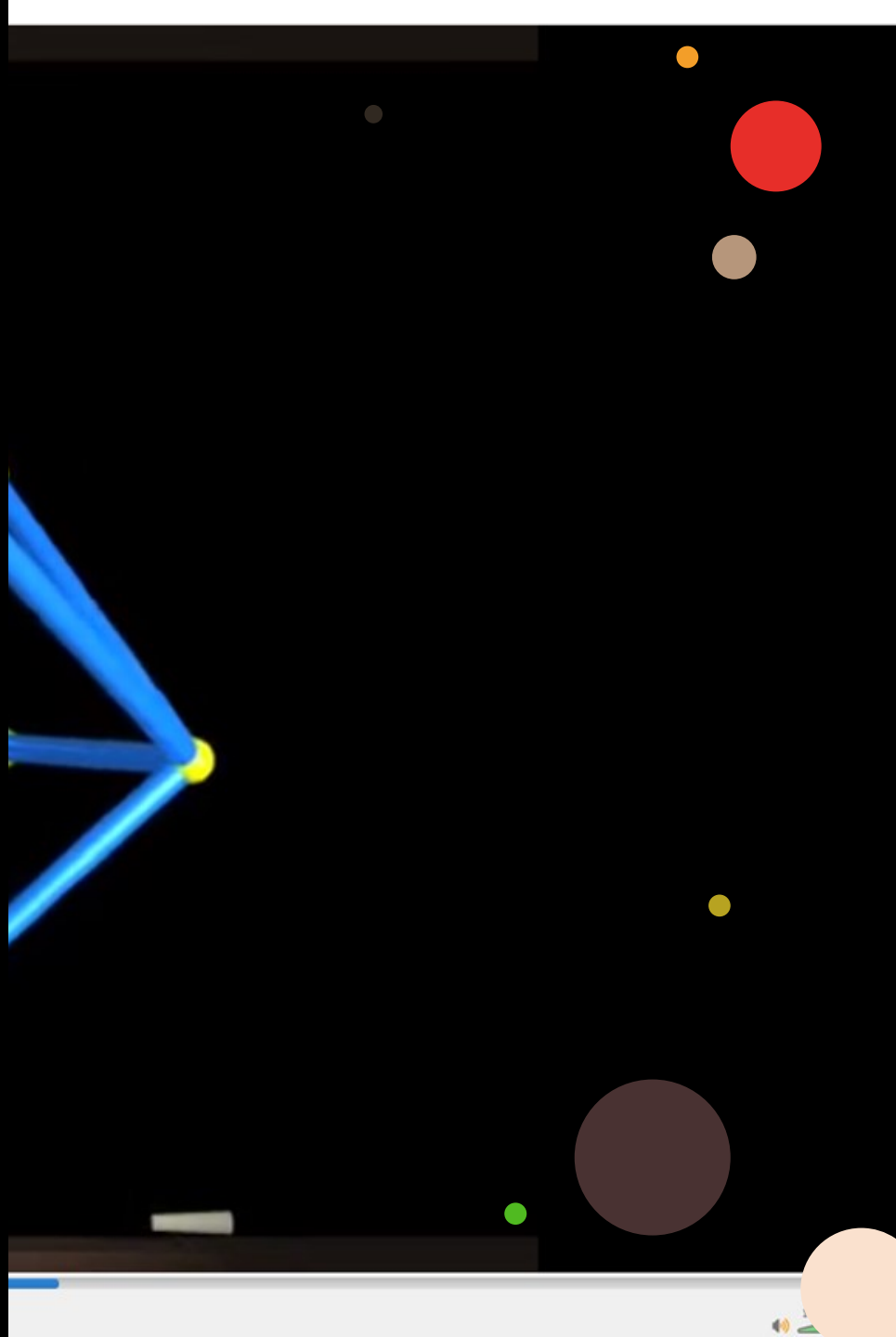
…weitere Besucher

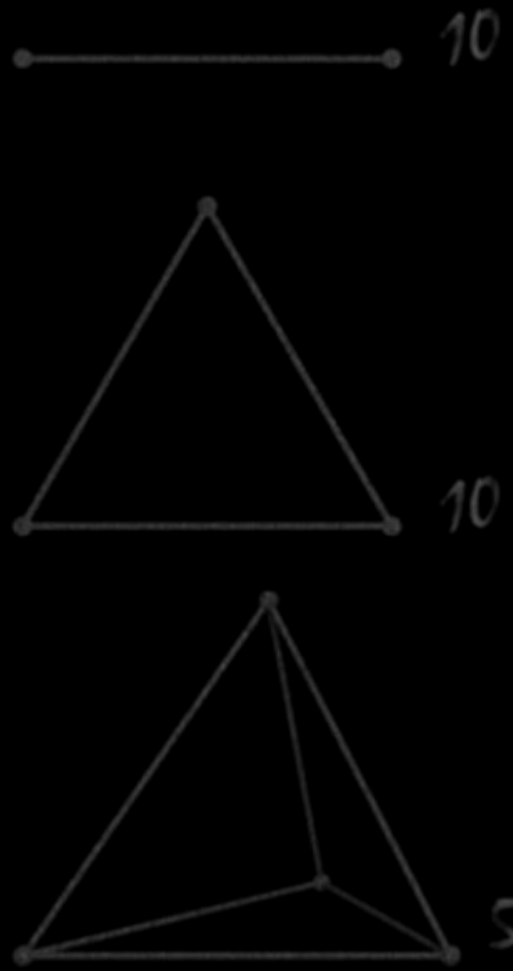


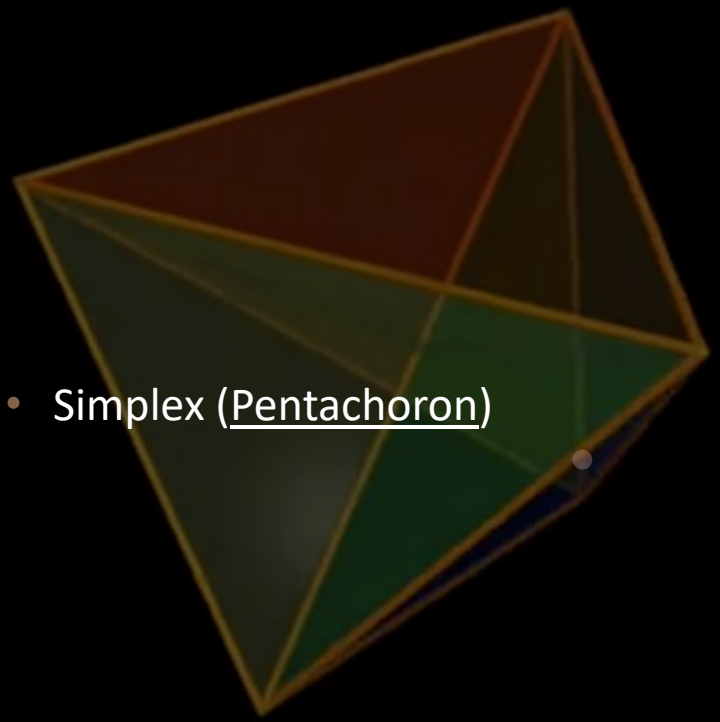




Hyperwürfel (Tesserakt)



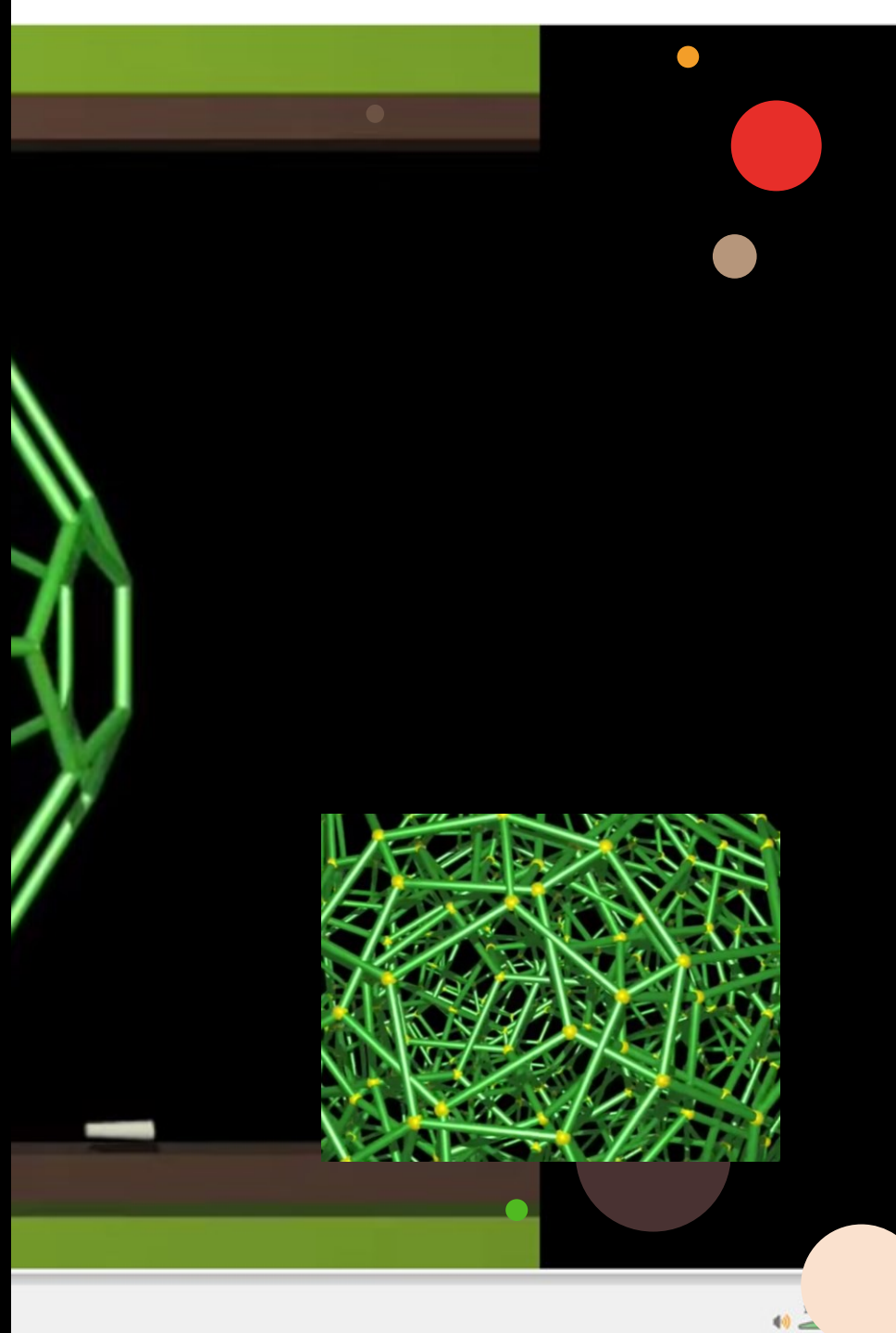




- Simplex (Pentachoron)

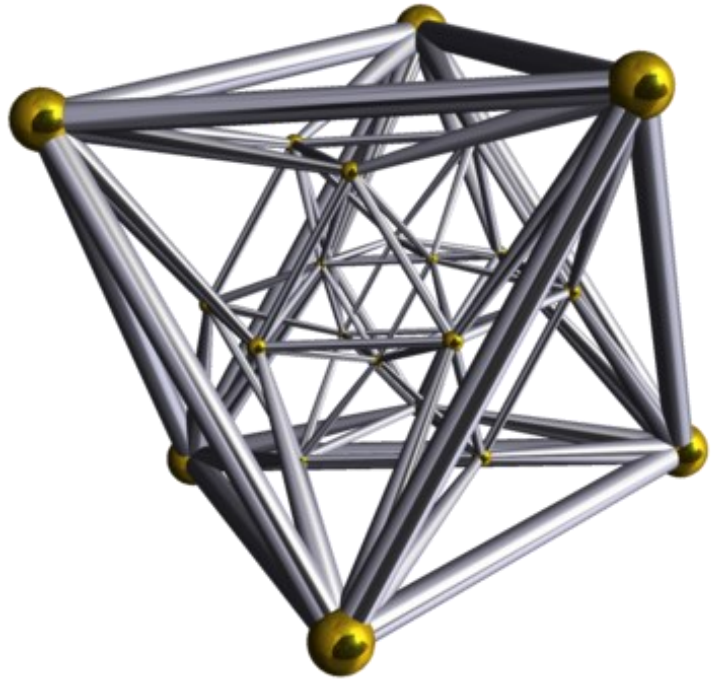
Hekatonikosachor

120 Dodekaeder

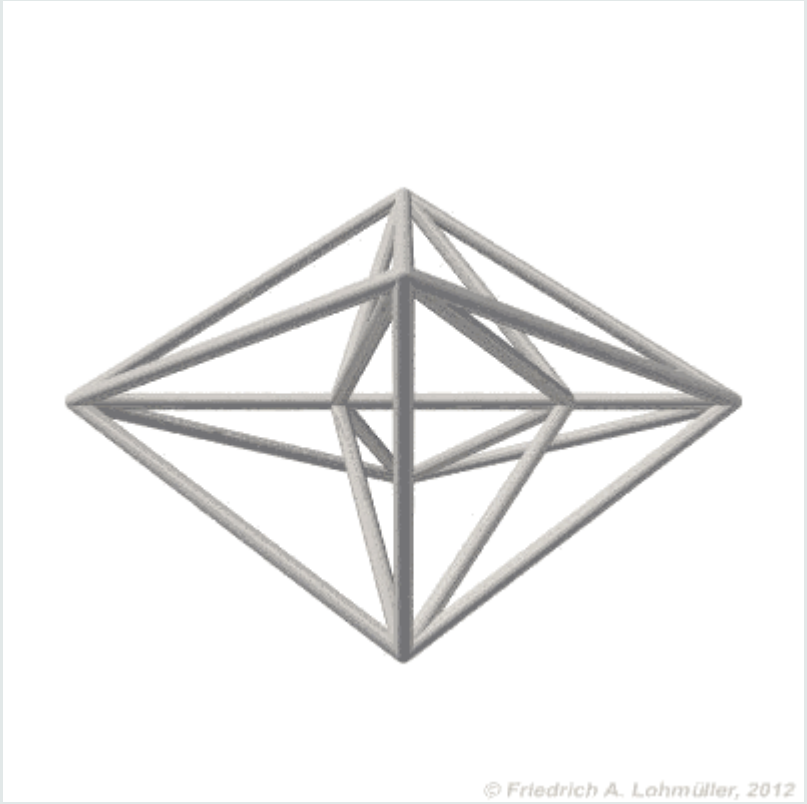


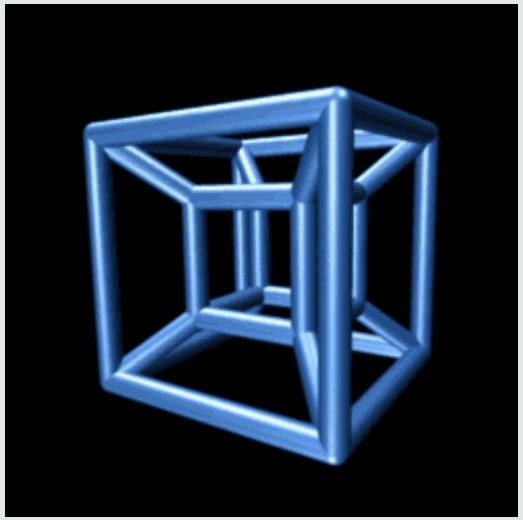
Sechster platonischer Körper

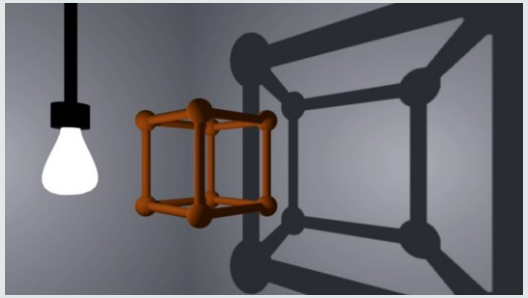
Ikositetrachor (24 Oktaeder)



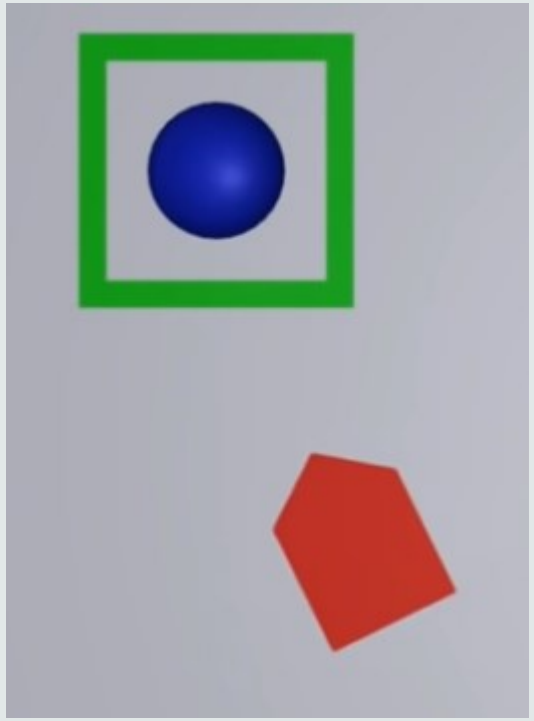
Im 5-dimensionalen Raum – und auch in allen Räumen höherer Dimension – gibt es statt fünf oder sechs nur noch drei reguläre Polytope: als Simplex das Hypertetraeder, als Maßpolytop den Hyperkubus und als Kreuzpolytop dessen Dual, das Hyperoktaeder.

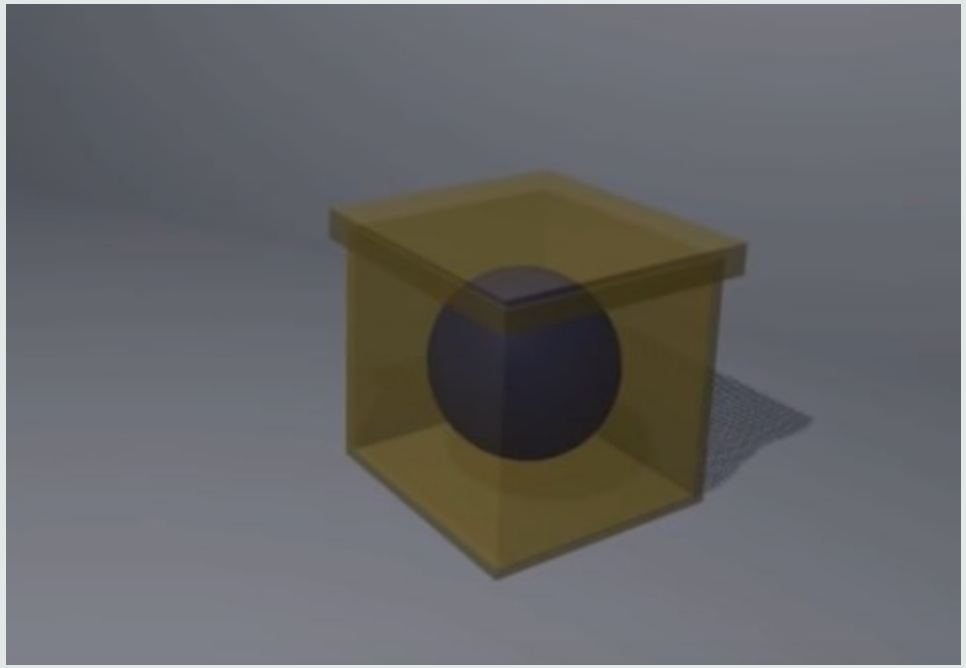




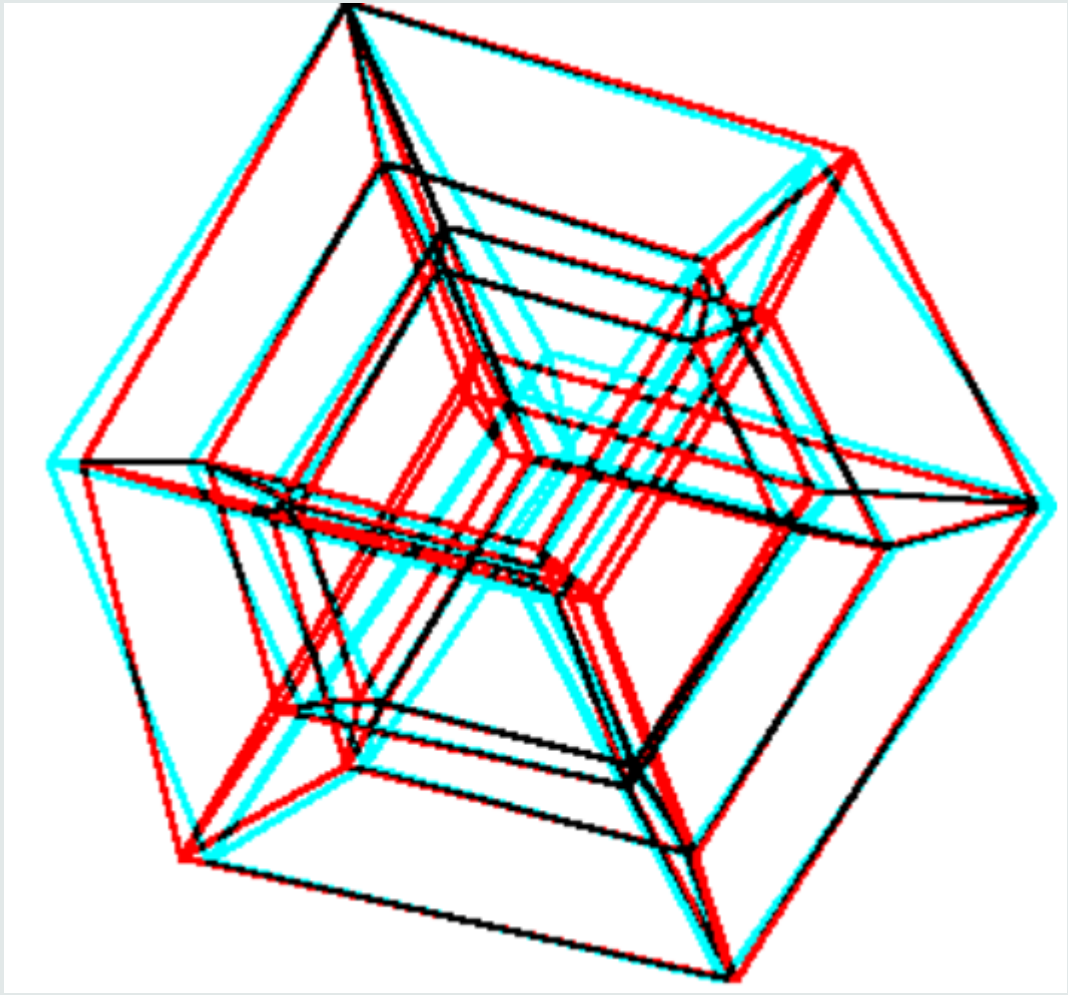


https://www.youtube.com/watch?v=j-ixGKZlLVc

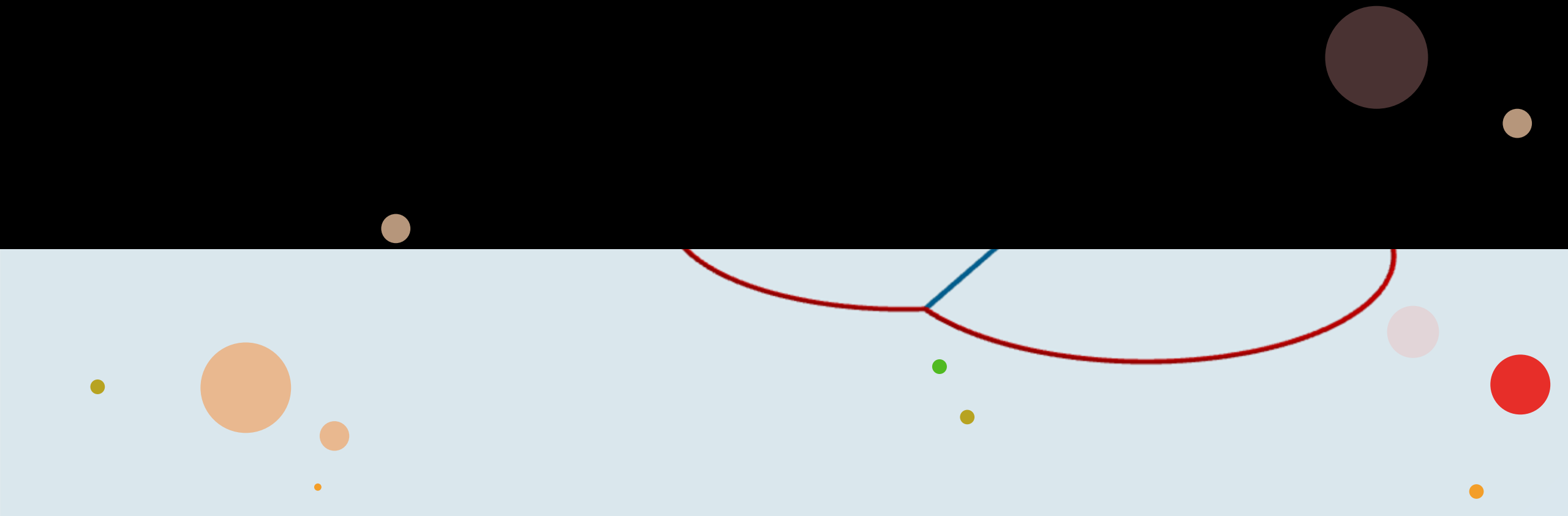




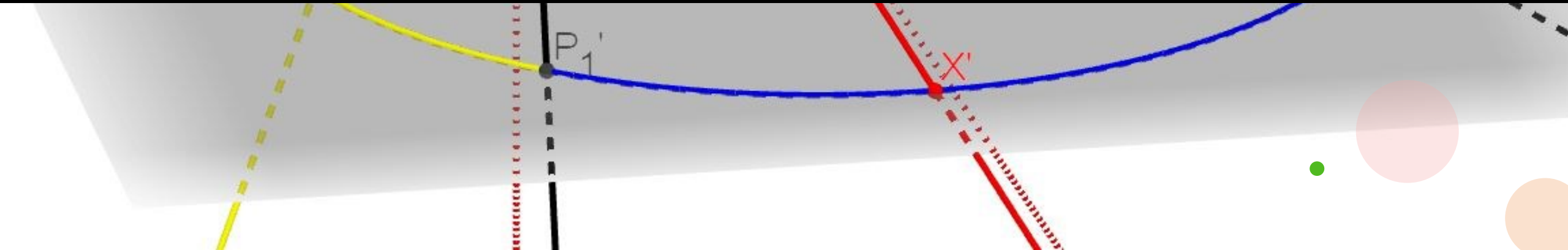
5D-Würfel: Anaglyphenansicht

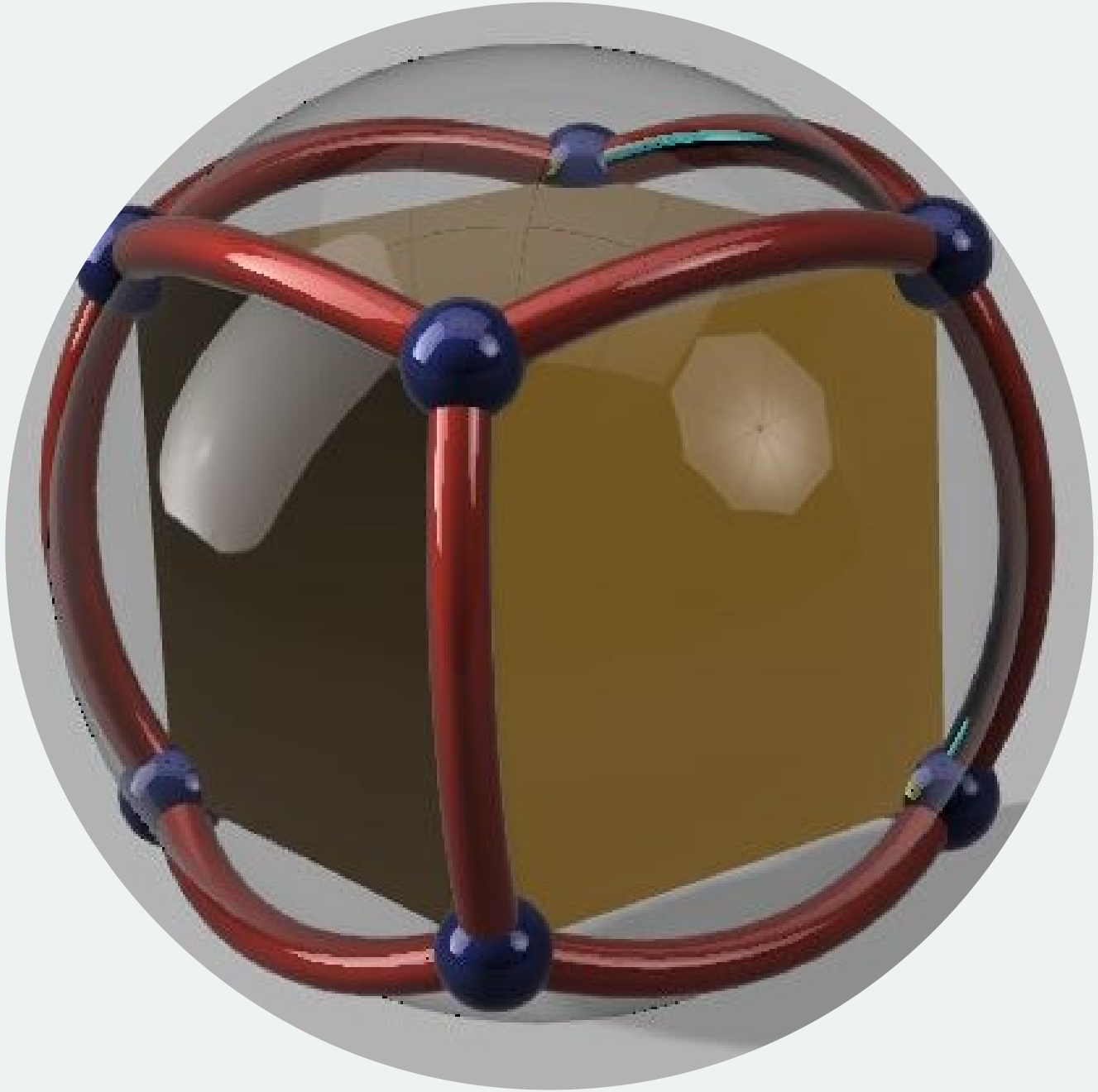


Neue Idee

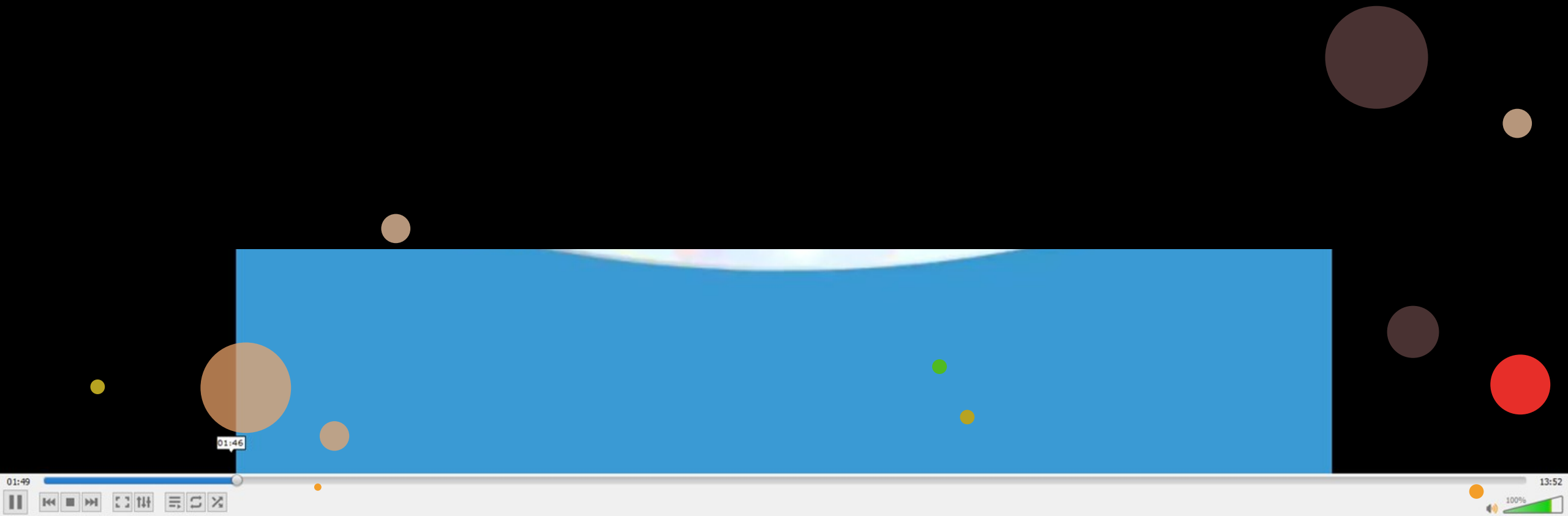


Stereographische Projektion



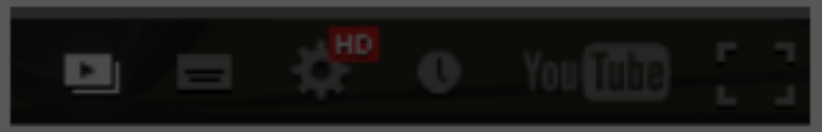


Tetraeder



Watch the films online here! (The American English version contains many subtitles)

Clicking on the language of your choice will bring up the player. Click on the triangle in the center of the screen to start chapter 1.



With these icons, from left to right, you can choose the chapter, choose subtitles, choose the video quality, watch later, watch in YouTube, and watch fullscreen.

http://www.dimensions-math.org/Dim_regarder_E.htm

Deutsch American English Français Español Italiano 日本語 Русский العربية

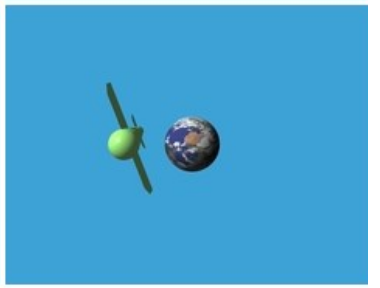
The English language films are also available at Isallaboutmath.com, Julio de la Yncera's site.

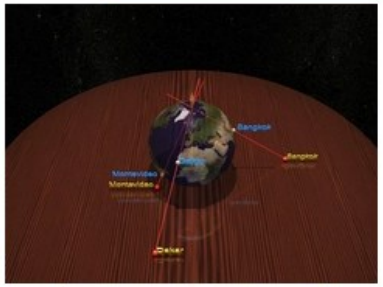
Chapter 1

Dimension two.

Hipparchus shows us how to describe the position of any point on Earth with two numbers...



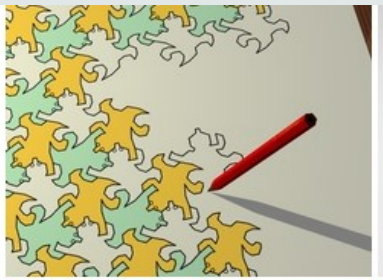
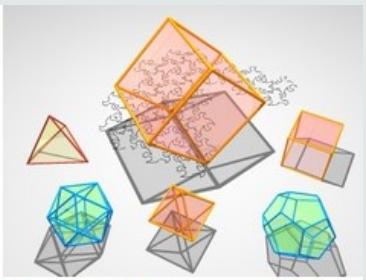
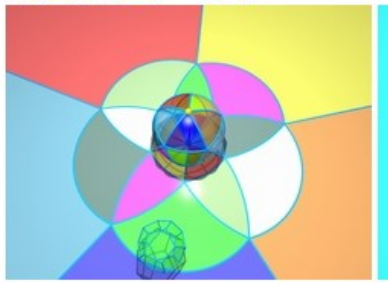
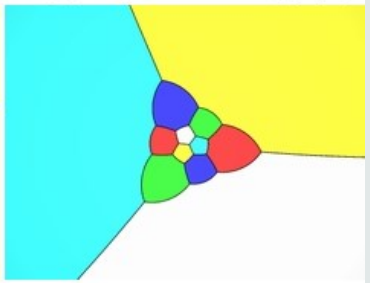



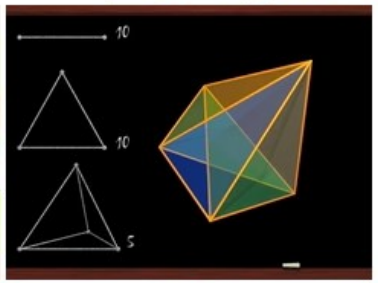
...and explains the stereographic projection : how to draw a map of the world.

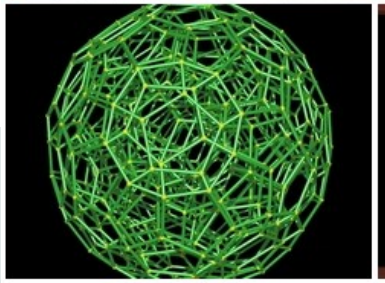
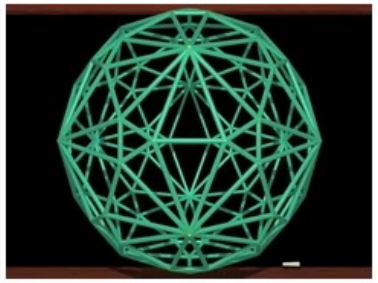
Chapter 2

Dimension three

M.C. Escher talks about the adventures of two-dimensional creatures trying to imagine what three-dimensional objects look like.

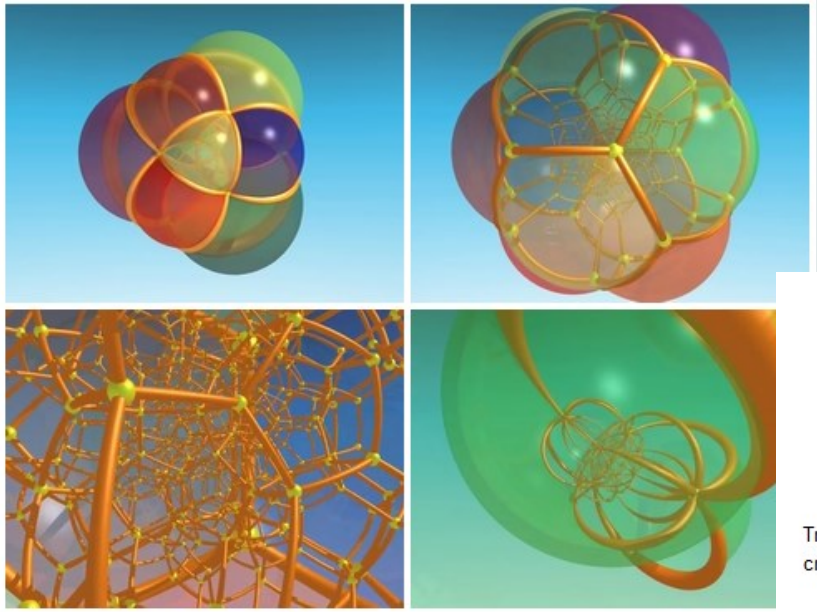



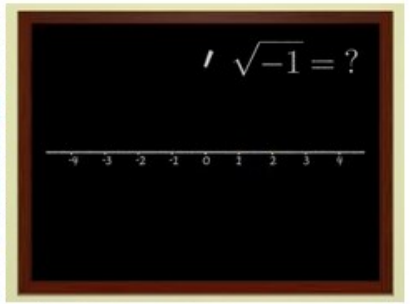
Chapters 3 and 4

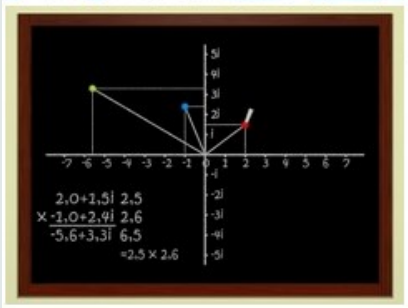
The fourth dimension

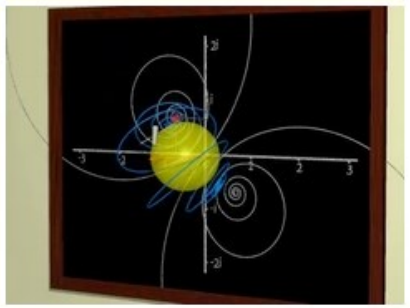
Mathematician Ludwig Schläfli talks about objects that live in the fourth dimension...

..and shows a parade of four-dimensional polytopes, strange objects with 24, 120 and even 600 faces !







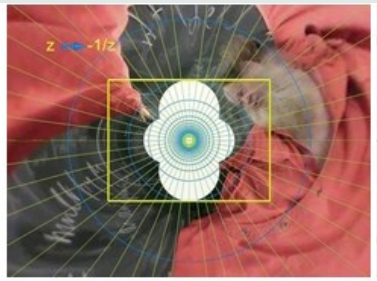


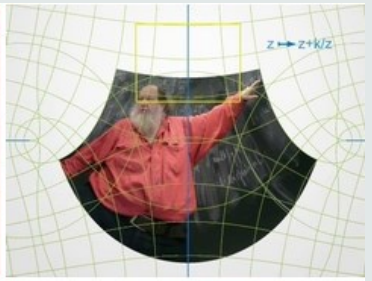
Chapters 5 and 6

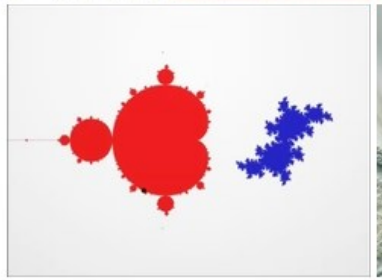
Complex numbers

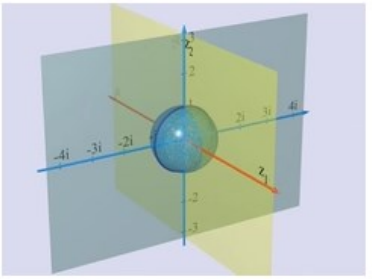
Mathematician Adrien Douady explains complex numbers. The square root of negative numbers made easy !

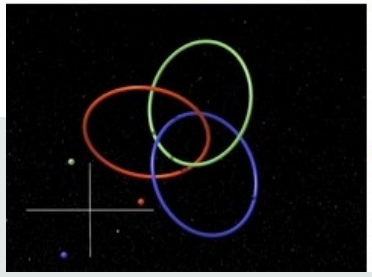
Transforming the plane, deforming images, creating fractal images...

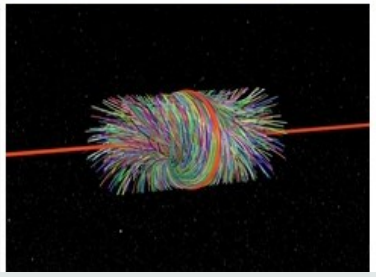










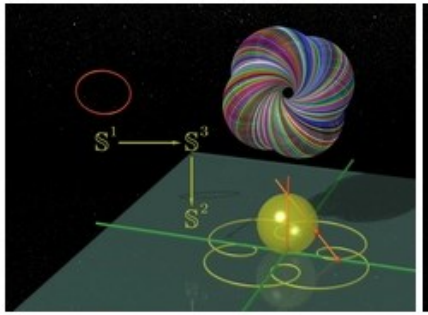


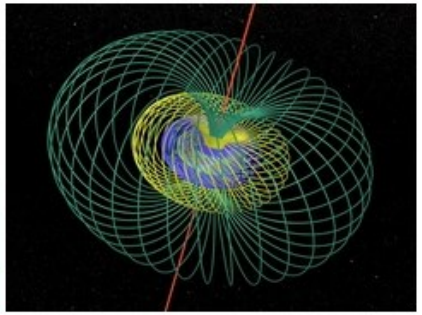
Chapters 7 and 8

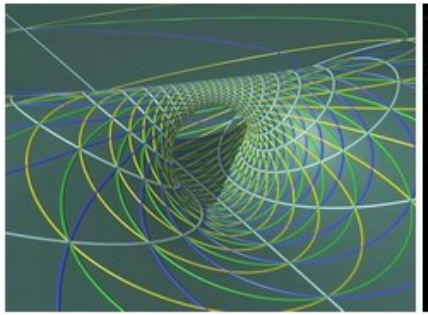
Fibration

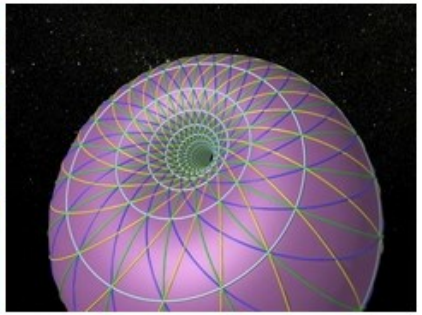
Mathematician Heinz Hopf explains his "fibration". Using complex numbers he constructs pretty patterns of circles in space.

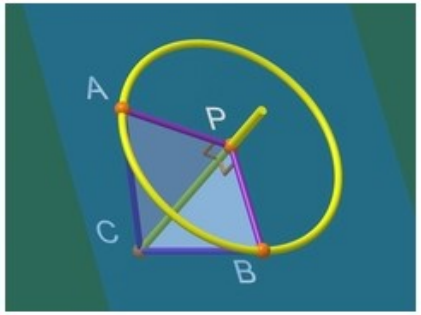
Circles, tori... everything rotating in four-dimensional space.

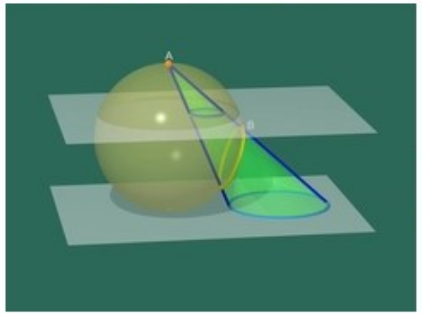


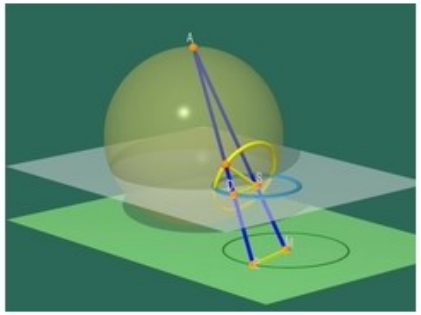










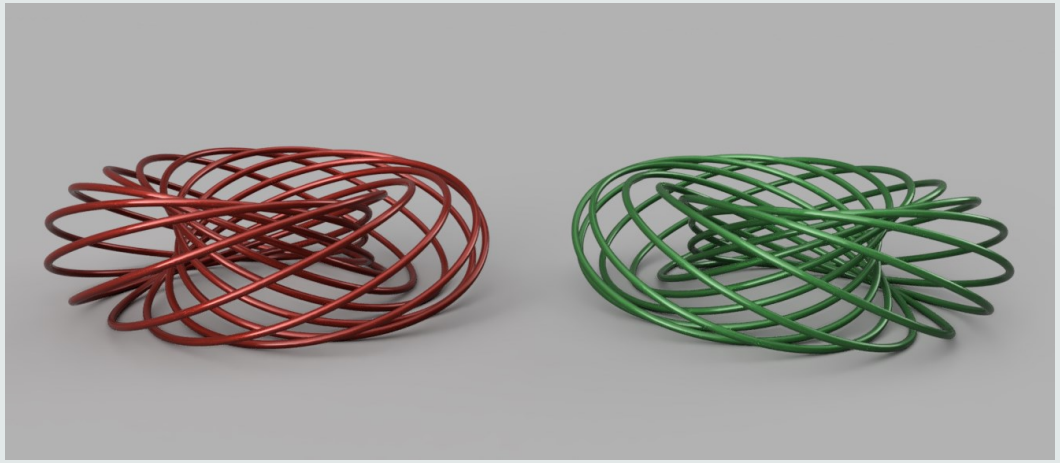


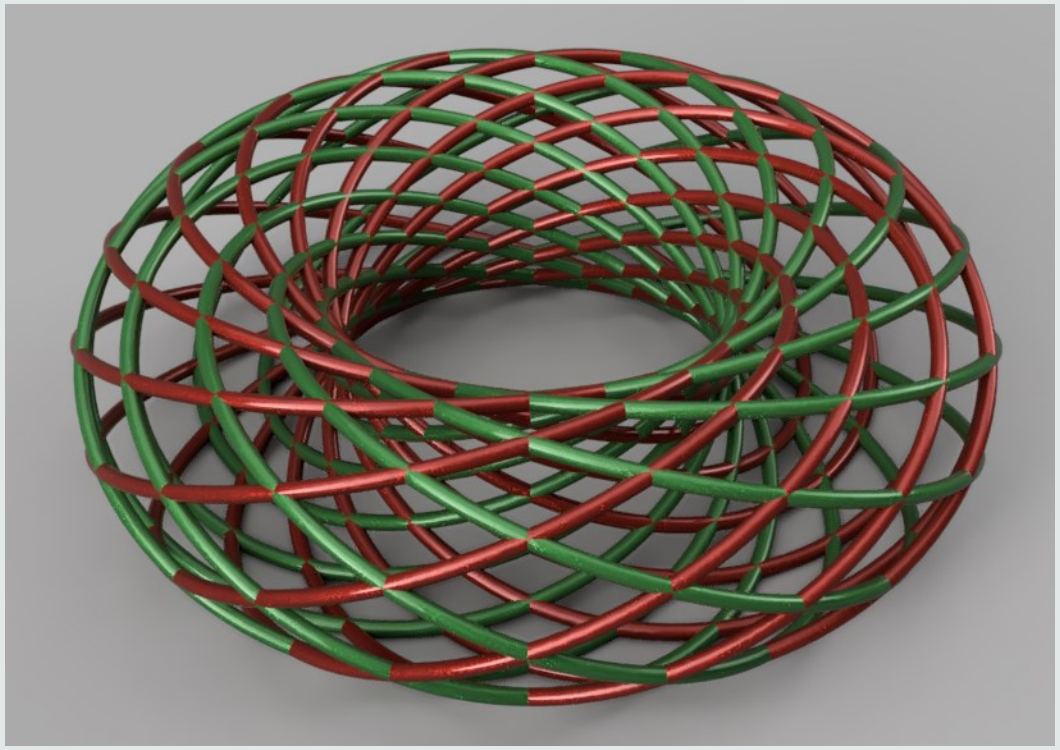
Chapter 9

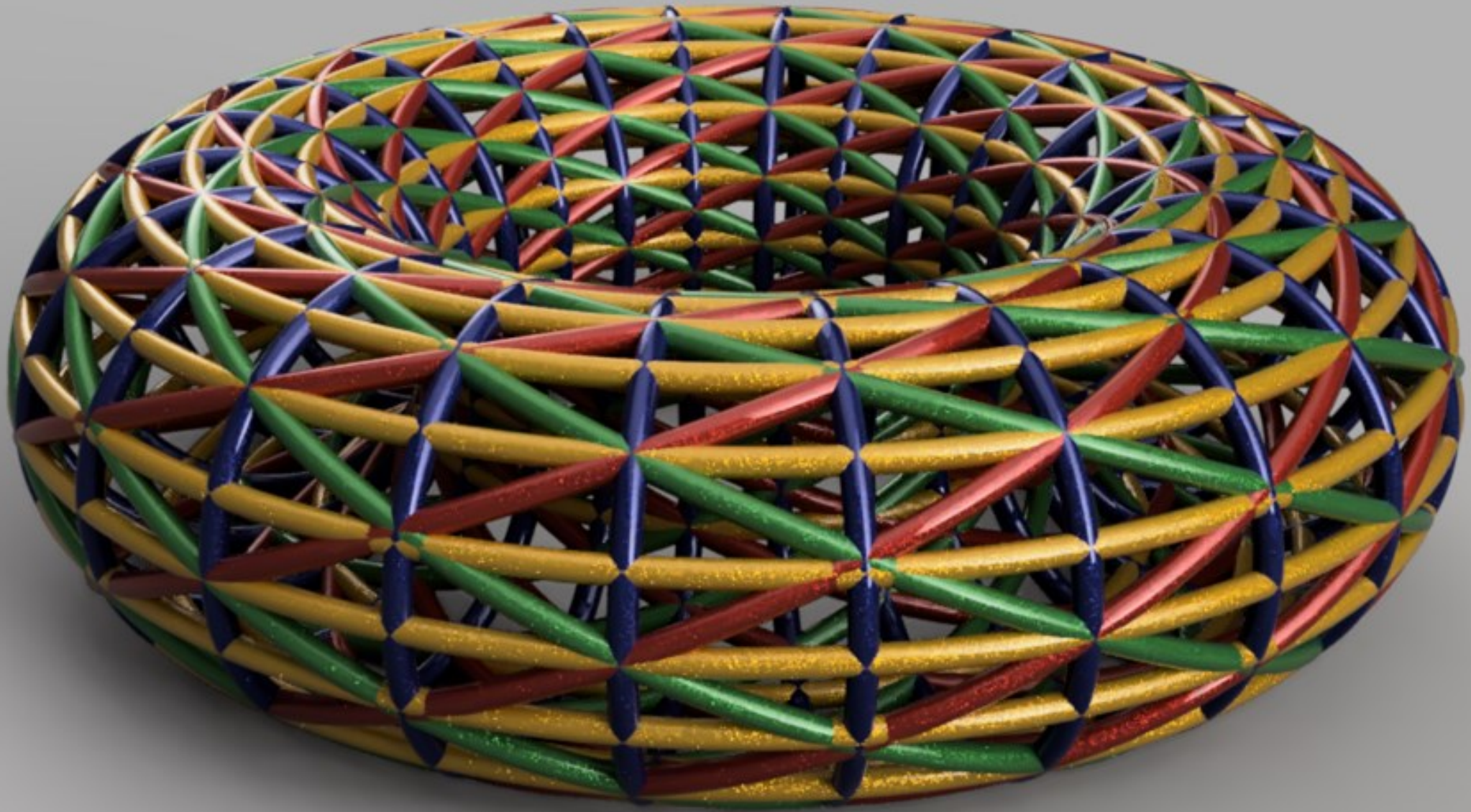
Proof

Mathematician Bernhard Riemann explains the importance of proofs in mathematics. He proves a theorem concerning the stereographic projection.

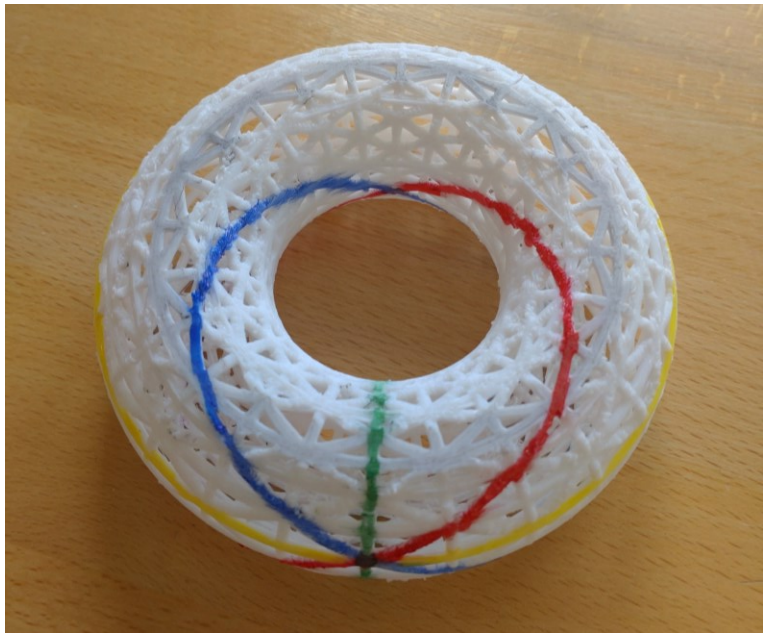
Torus

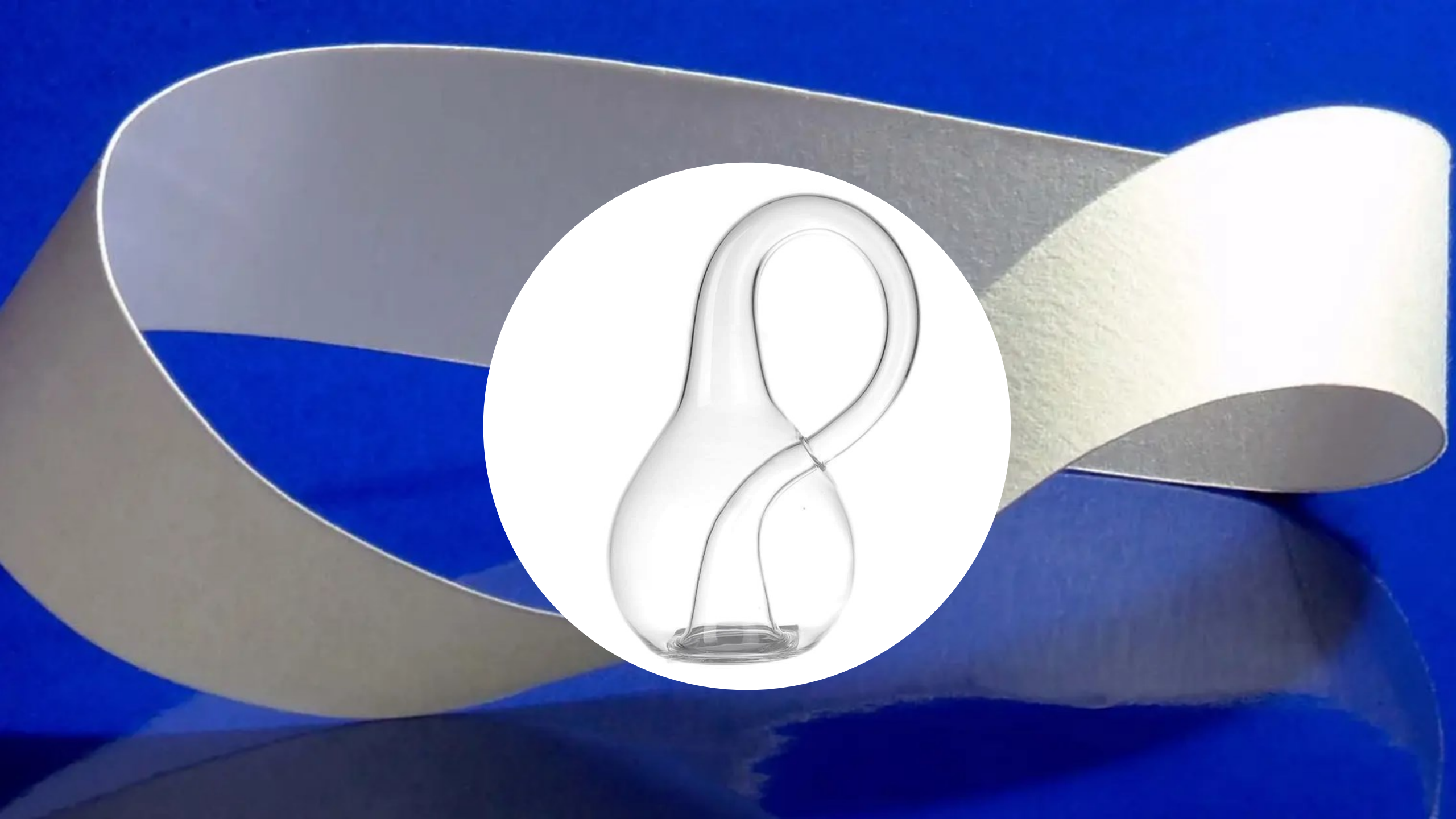






4 Kreise





https://www.youtube.com/watch?v=I6cgca4Mmcc