



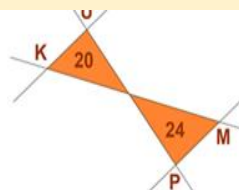
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6. KONFERENCA O UČENJU IN POUČEVANJU MATEMATIKE

Laško, 11. in 12. november 2024

GEOMETRIJA III.

6. konferenca o učenju
in poučevanju matematike
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Geometrija skozi čas

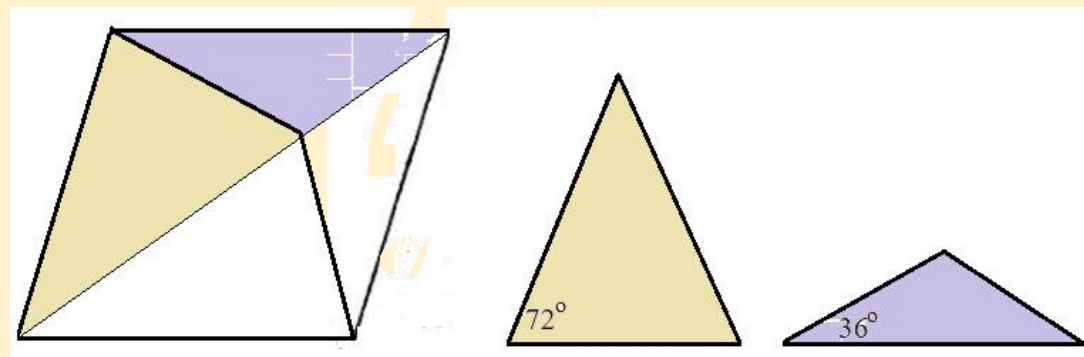
„Od nemogočega predmeta do Nobelove nagrade“

Gregor Pavlič



Nemogoče je mogoče

... ali kako preprosti življenjski dogodki vplivajo
na velika odkritja in celo na prejem Nobelovih nagrad ...
... posredi pa je geometrija ...



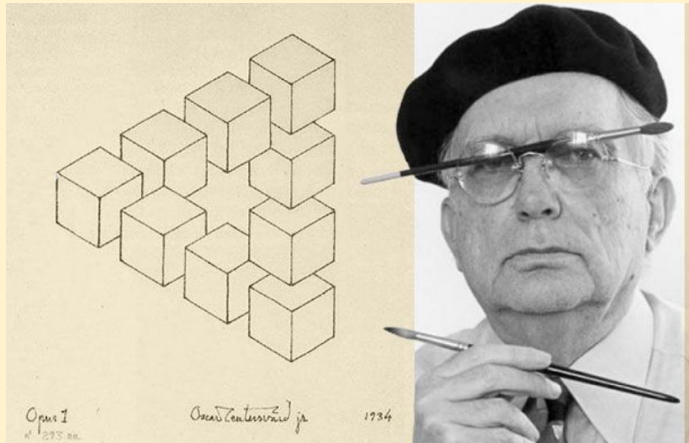
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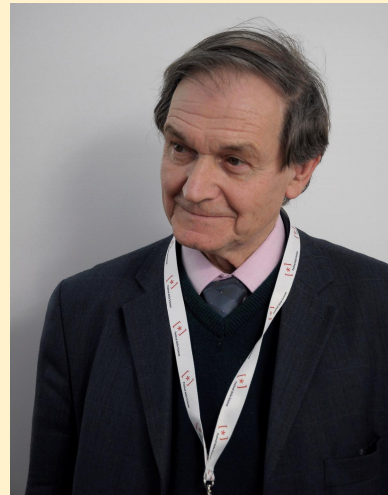
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Oscar Reutesvaard (1915 - 2002)



Roger Penrose (1931)



IMPOSSIBLE OBJECTS: A SPECIAL TYPE OF VISUAL ILLUSION

BY L. S. PENROSE AND R. PENROSE
(University College, London, and Bedford College, London)

Two-dimensional drawings can be made to convey the impression of three-dimensional objects. In certain circumstances this fact can be used to induce contradictory perceptual interpretations. Numerous ideas in this field have been exploited by Escher (1954). The present note deals with one special type of figure. Each individual part is acceptable as a representation of an object normally situated in three-dimensional space; and yet, owing to false connexions of the parts, acceptance of the whole figure on this basis leads to the illusory effect of an impossible structure. An elementary example is shown in Fig. 1. Here is a perspective drawing, each part of which is accepted as representing a three-dimensional rectangular structure. The lines in the drawing are, however, connected in such a manner as to produce an impossibility. As the eye pursues the lines of the figure, sudden changes in the interpretation of distance of the object from the observer are necessary. A more complicated structure, not drawn in perspective, is shown in Fig. 2. As this object is examined by following its surfaces, reappraisal has to be made very frequently.

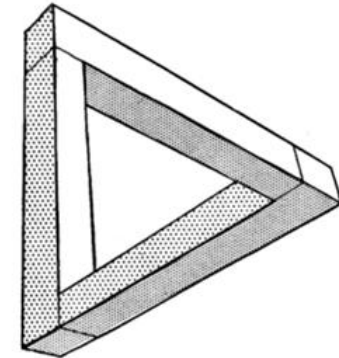
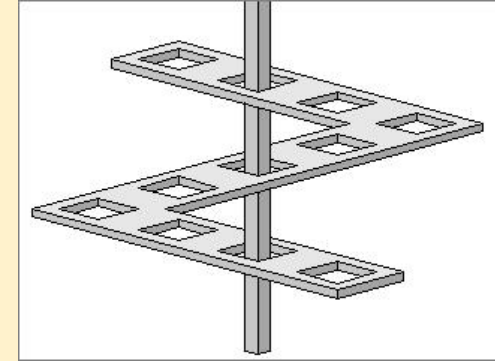
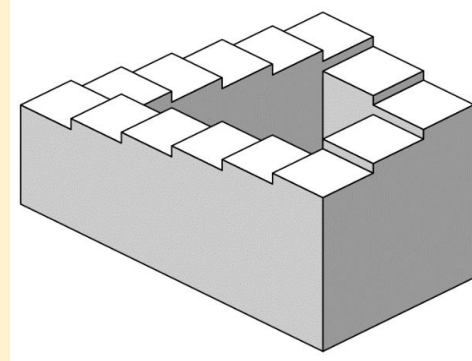
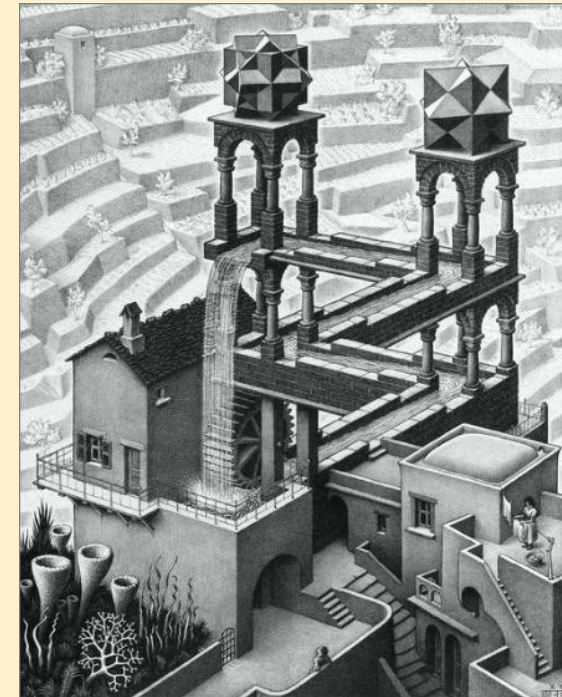
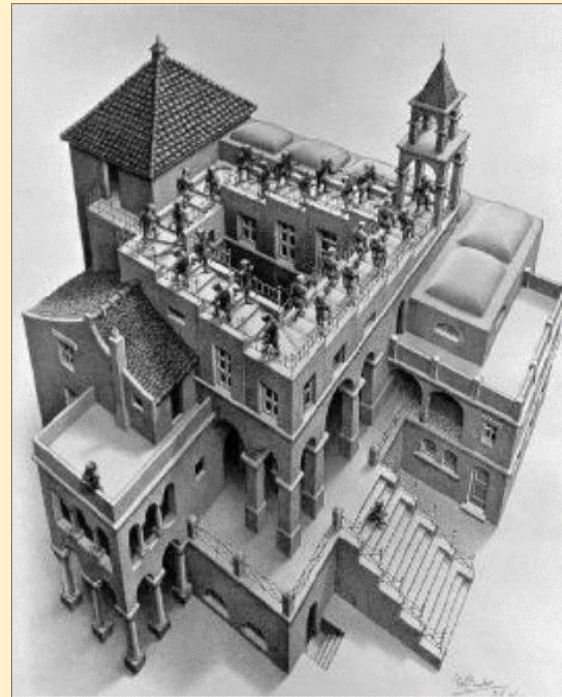
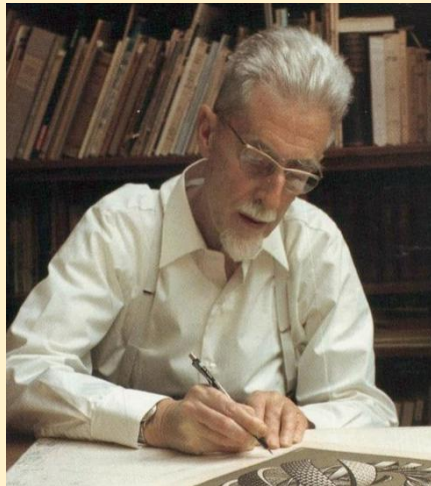


Fig. 1. Perspective drawing of impossible structure.

Another way of presenting the same type of illusion is to express the impossibility in terms of such a phenomenon as a continually descending or ascending path. The flight of steps drawn in Fig. 3 is an example of this. Each part of the structure is acceptable as representing a flight of steps but the connexions are such that the picture, as a whole, is inconsistent; the steps continually descend in a clockwise direction.



Maurits Cornelis Escher (1898 – 1972)



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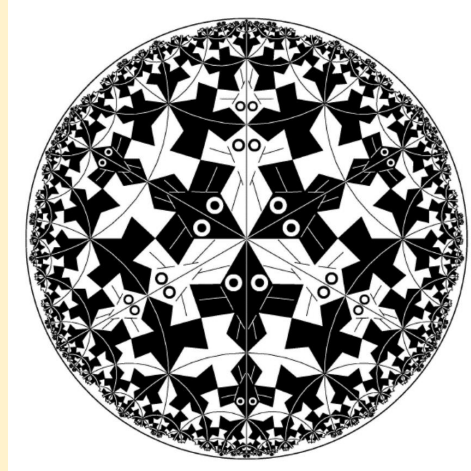
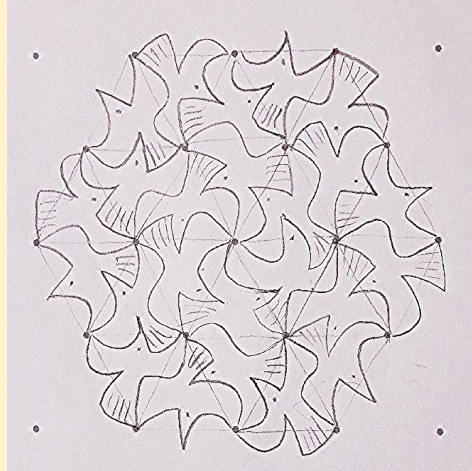
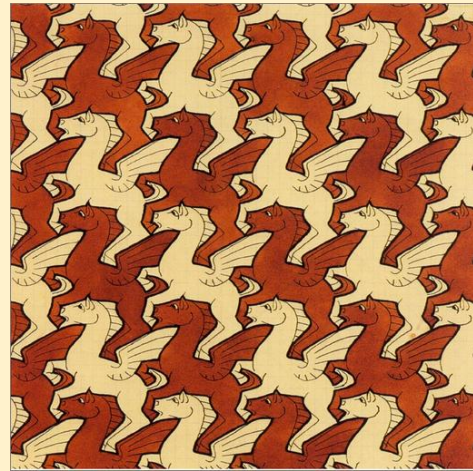
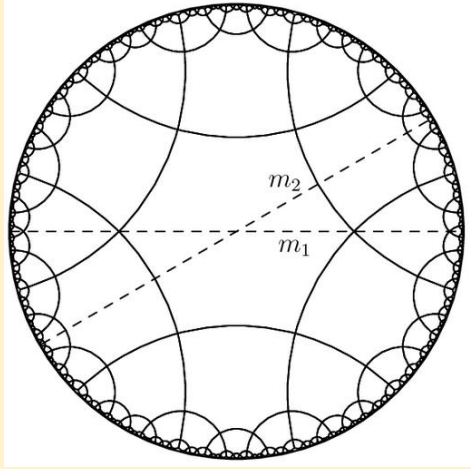
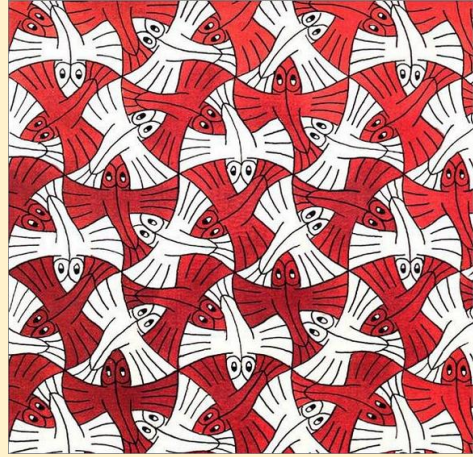
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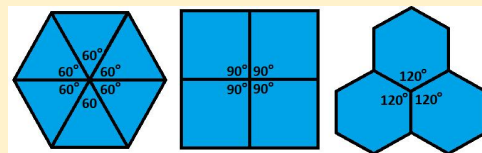
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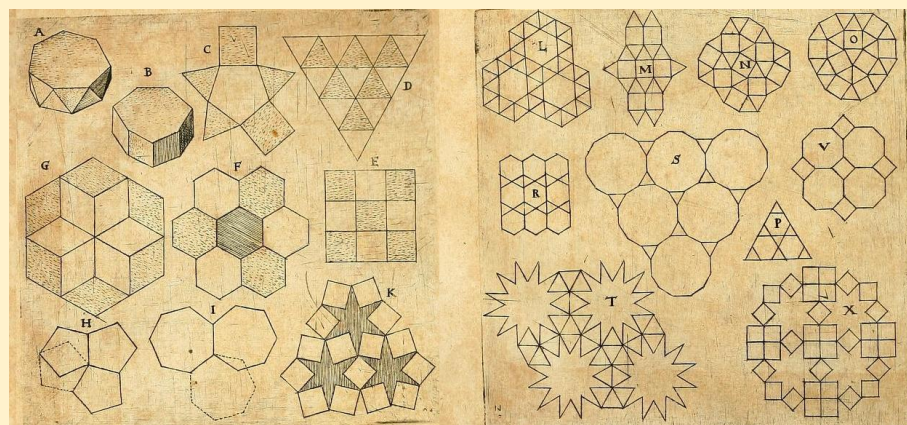
1954



Kako dobiti ploščičarja?



Johannes Kepler: *Harmonices Mundi*, II/V (1619)

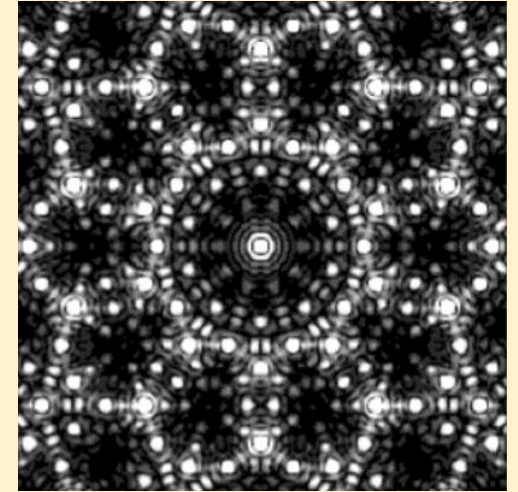
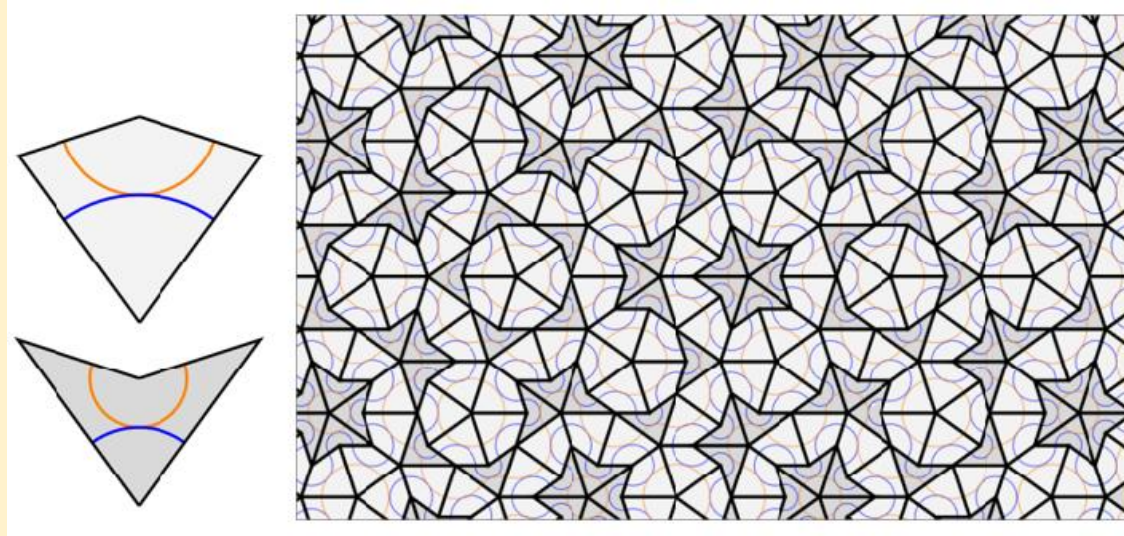


 3.12^2 $(t=2, e=2)$	 $3.4.6.4$ $(t=3, e=2)$	 $4.6.12$ $(t=3, e=3)$	 $(3.6)^2$ $(t=2, e=1)$
 4.8^2 $(t=2, e=2)$	 $3^2.4.3.4$ $(t=2, e=2)$	 $3^3.4^2$ $(t=2, e=3)$	 $3^4.6$ $(t=3, e=3)$



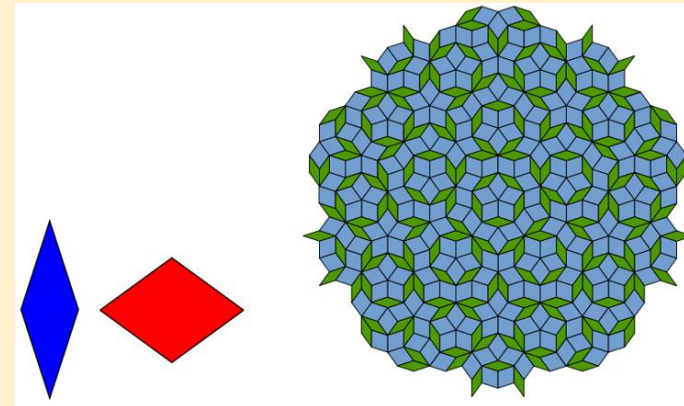
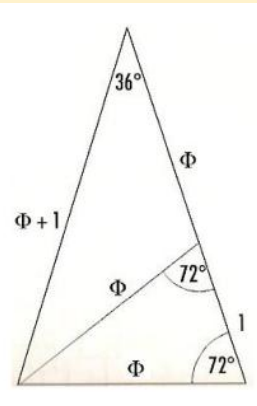
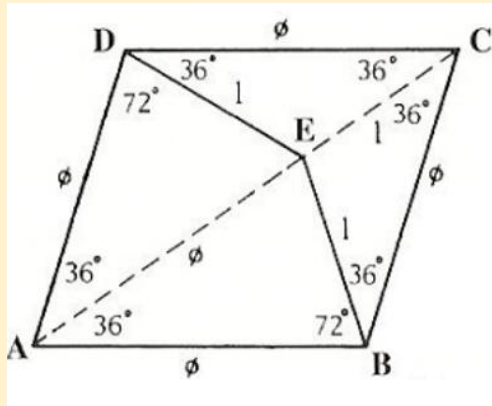
1954

1984



Sipanje X žarkov na zlitini aluminija in mangana (Steinhard in Levine); *šehtmanit*

1974



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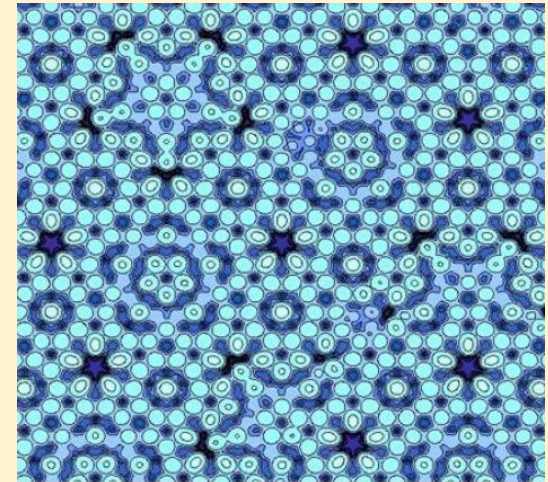


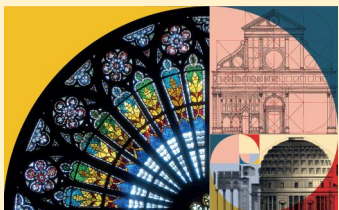
Daniel Shechtman (1941),
nedeljena Nobelova nagrada za
kemijo, 2011

Od nekdaj je v kristalografiji veljalo, da imajo *kristali* 2-, 3-, 4- in 6-števne osi; to pomeni, da vzorec zavzame kristalografsko identične položaje dvakrat, trikrat, štirikrat ali šestkrat znotraj zasuka za 360° . Kvadrat s sučno osjo v središču, ima 4-števno simetrijo.

S *kvazikristali* so se stvari popolnoma spremenile, saj imajo za razliko od kristalov 5-, 8-, 10- ali 12- števnih sučnih osi. Zato imajo kvazikristali posebne magnetne, električne in mehanske lastnosti.

Atomski model šehtmanita (Al-Mg)





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Roger Penrose, 2020
Nobelova nagrada za fiziko za odkritje,
da je *nastanek črnih lukenj robusten*
prediktor splošne teorije relativnosti.

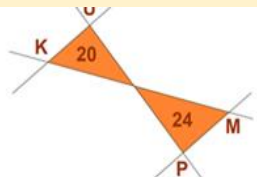


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Hvala za vašo pozornost
in nadaljnja vprašanja.

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