

Topology games by Nikos

Topology is the mathematical study of shapes and spaces. It involves looking at the shapes that result through stretching, transforming, deforming, folding and twisting. Topology is used in many branches of mathematics, such as differentiable equations, dynamical systems, knot theory, and Riemann surfaces in complex analysis. It is also used in string theory in physics, and for describing the space-time structure of universe.

Definition of topology

Topology is a special **form of geometry**. What distinguishes topology from other geometric studies is that topology treats geometric shapes as substantially ("topologically") equivalent if you can bend, twist, and otherwise deform them to convert them to each other.

This sounds a bit strange, but consider that if you make a circle and start rusting from four directions, with careful rust you can create a square. Thus, a square and a circle are topologically equivalent. Similarly, if you bend one side of a triangle until you create another angle somewhere along that side, with more bending, pushing, and pulling, you can turn a triangle into a square. Again, a triangle and a square are topologically equivalent.

Topology is the branch of mathematics that studies mainly those properties of geometric shapes which remain unchanged in topological representations. The concept of topological representation is equivalent to the deformation of a geometric shape. However, the deformation must occur in such a way that:

- Do not break the original shape

- Do not close any gaps it contains

The shape resulting from a topological representation is considered topologically equivalent or homogeneous to the former.



The topology of pac-man

A typical example of a topology game is pac-man, a 1980 video game.

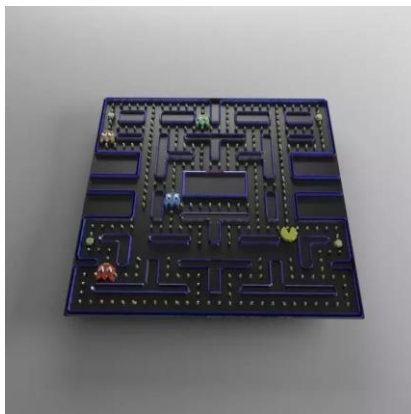
When you play the game you believe that Pacman lives on a flat surface, however this is not the case.



We know that if Pacman goes off the edge of one side, he will reappear on the other side.

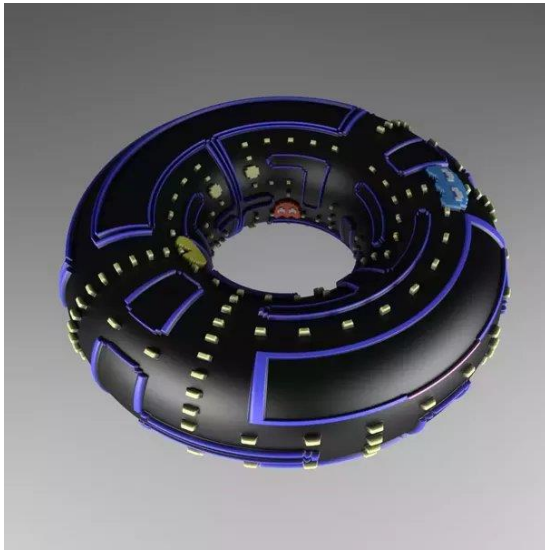
This cannot happen if the surface is flat. But we can intuitively view this

by taking our flat plane, and gluing together the edges to make a cylinder.



We also know that going too far up will transport Pacman to the bottom of the plane (now cylinder)

To make this into a 3D surface, we'll "glue" the two bases of the cylinder together to get a torus.



That's the "planet" which Pacman lives on in three dimensional space.

On our planet, we made the observation that going off in any direction will result in ending up where you came from. From this we can deduce that the earth is round.

Similarly, in Pacman's universe, the observation that opposite sides of the plane are somehow identical leads to the toroidal structure of Pacman's world.