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Topology Disturbing Objects: Anamorphic, Ambiguous and Impossible Designs

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A B S T R A C T

This paper presents a basic study on topology disturbing designs. Topology disturbing designs can create a visual effect of an illusion. Few of the topology disturbing designs are anamorphic drawings, impossible objects, ambiguous objects and etc. In this paper, the above mentioned techniques are discussed. Anamorphic projections create the distorted image, and the distorted image can be sensed only from one specific point through an optical device. Impossible designs also can be sensed from one specific viewpoint. Ambiguous objects can be sensed from two different viewpoints. These three different techniques have a common relation that they are topology disturbing designs. These are explained individually by taking few examples and also explained the relationship between anamorphosis and impossible designs in this paper.

Keywords: Topology disturbing designs, Impossible designs, Anamorphic Projections, illusion painting, a regular shape, square, convex lens, distortion.

Anamorphic designs

The word, Anamorphic comes from Greek. *Ana* means again and *morphe* means shape. An anamorphic image appears abnormal from all the remaining angles except from the correct viewpoint through an optical device i.e., a convex lens. Once the anamorphosis is realized, they can be read without using any optical devices. There are various ways to create anamorphic drawings using mathematical formulae, projectors, some kind of software and etc. This will create the illusionary effect on different surfaces like on ground, wall, cylindrical, conical shape mirrors and etc.

"The Ambassadors" by Hans Holbein the Younger (1536)

"The Ambassadors", art work is the early and most famous example of the drawing using anamorphic projection techniques by Hans Holbein the Younger (1536), shown in Fig.1. In this painting, an unrecognizable object contrasting the rest of the painting which is composed of clearly and precisely rendered elements at the feet of the ambassadors. That floating figure or unrecognizable object in the foreground of the painting is an anamorphic projection of a skull, shown in the corrected form in the right part of the Fig.1 by moving close to the wall at the right side of the image. The Anamorphic designs look like abnormal designs or little dragged. This is based on the size of the art what to be painted on the surface. The Fig.2 shows the distorted view of the drawing. The Fig.3 shows the successful execution of the distorted design is given.

Fig.1 "The Ambassadors" by Hans Holbein the Younger

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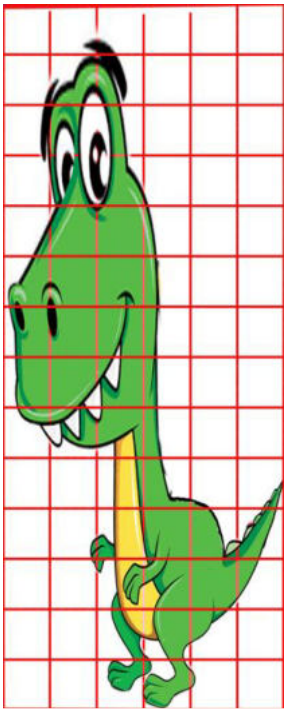

Fig.2 The distorted view of the dinosaur art

Fig.3 The 3D view of the dinosaur art

The distorted view of the dinosaur art is shown in Fig.2. The size of the dinosaur art is in the Fig.2 is 14 feet length and 6 feet width. When it is excuted on a plane surface and seen from a specific view point which is 6 feet away from it through a convex lens, It looks like a 3D model of dinosaur art is standing on the ground.

The Fig.4 is another example for the same anamorphic designs which explains the importance of the view point. If the art work is not seen from a specific view point, it looks totally abnormal. The Fig.4 is taken from the correct view point and looks as a depth or pool. The Fig.5 is taken from another view point (Back view) and looks meaningless.

Fig.5 The back view of the pool appears as meaningless

Fig.4 The correct view of the pool appears as meaningful

Ambiguous designs

Topology disturbing objects look like they disturb the topological properties when they are observed from two or more specific view points.They appear to be disturbed when they are observed from other viewpoints.Due to the the phenomenon of an optical illusion, it can be sensed like that, but it can't happen physically. Kokichi Sugihara is a Japanese mathematician and artist known for his three-dimensional optical illusion, has done many experiments in this area one of his works is given in the Fig.6 as an example. Humanbeing can't be there in front and back of the object simultaneously to observe the views at a time. So, there is an effective method to present two views i.e., using a mirror. By placing a topological disturbing object or an ambiguous object in the mirror appropriately, the reflection of the object can be observed and thus two appearances can be compared if the topologies are different from each other. It looks like impossibility.

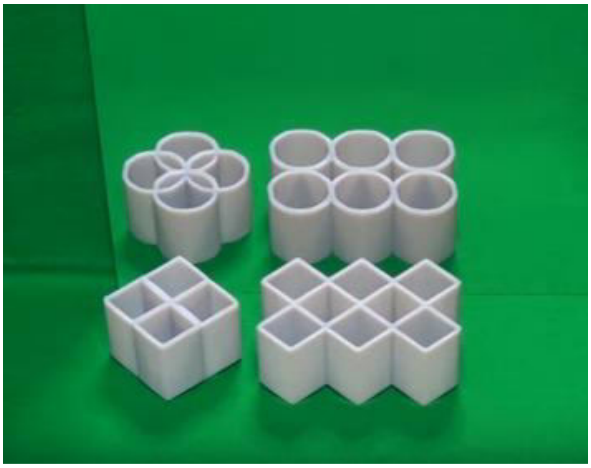

Fig.6 Topology disturbing objects by Kokichi Sugihara

Examples of ambiguous objects

The visual effect of topology change can be considered as one of the variants of traditional anamorphosis and anamorphic drawing on a plane or on a surface looks meaningful when it is observed from a specific view point through an optical device or a lens generally convex lenses or a camera lens is used to observe the effect. But, the same anamorphic drawing looks meaningless when it is seen from a general or other viewpoint.

Fig.7 a cylinder is perceived as a prism

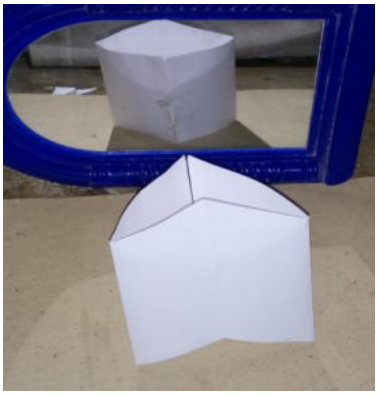

Fig.8 a triangular prism is perceived as a square prism

The above figures are the simple experiments. From a specific viewpoint shown in Fig.7, a cylinder is perceived and it's reflection in the mirror is perceived as a prism. From a specific viewpoint shown in Fig.8, a triangular prism is perceived and it's reflection in the mirror is perceived as a square prism. It happens because of the topology disturbance.

Impossible Objects

The Penrose Impossible Triangle is one of the examples of impossible objects. This is a class of two-dimensional figure that appears to be realized in three dimensions, but it is not. This object is also referred to as an impossible triangle or Penrose tribar. It had actually been found in 1934 by Swedish artist Oscar Reutersvard, but Roger Penrose and Lionel Penrose discovered and analyzed it independently in 1958 that brought impossible objects prominently to the attention of psychologists, artists including Maurits Escher. The fig consists of essentially three orthogonal rods. When viewed from one direction and distance, it looks like the impossible triangle. Fig.9 shows The Penrose Impossible Triangle.

The Penrose Stairs is another impossible figure or impossible object. It depicts an object which does not possibly exist. It is impossible for the Penrose Stairs to exist because if it is to complete a circuit of the stairs, it should be ended up back at the same level where it begin, even though each stair continuously rises or falls, depending on the direction of travel. It is one of many types of impossible objects or designs. Artists such as Oscar Reutersvärd

and M. C. Escher have frequently used impossible designs/figures of varying types in their work, and many mathematicians have studied the mathematical and computational properties of impossible designs/figures to try and develop formulas and algorithms for modeling impossible objects, for use in such things as computer vision. Fig.10 shows The Penrose Stairs.

Fig.9 The Penrose Impossible Triangle

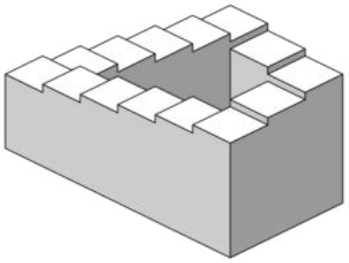

Fig.10 The Penrose Stairs

Anamorphic drawings of Impossible Objects

The distorted view of the Penrose Impossible Triangle is shownin fig. The size of the triangle is in the Fig.11 is 10 feet length and 4 feet width. When it is excuted on a plane surface and seen from a specific view point which is 6 feet away from it through a convex lens, It looks like a 3D model of Penrose Impossible Triangle is standing on the ground shown in Fig.12.

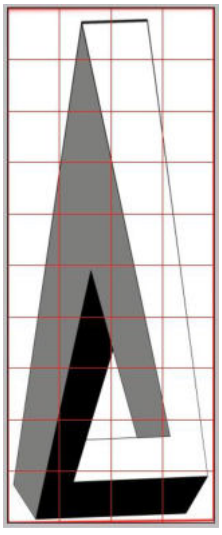

Fig.11 The distorted view of Penrose Impossible

Fig.12 The Penrose Impossible Triangle on a plane surface

The distorted view of the Penrose Stairs is shownin fig. The size of the Stairs is in the Fig.13 is 8 feet length and 6 feet width. When it is excuted on a plane surface and seen from a specific view point which is 6 feet away from it through a convex lens, It looks like a 3D model of Penrose Stairs is standing on the ground shown in Fig.14.

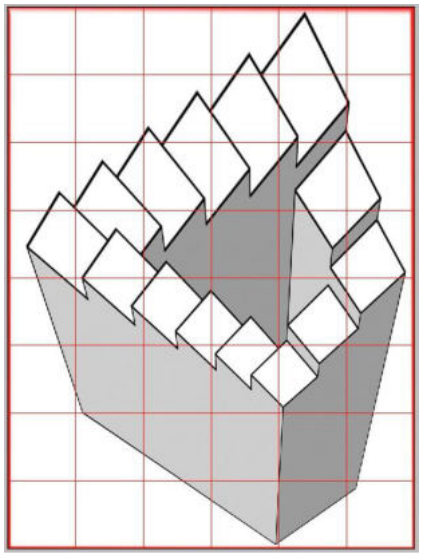

Fig.13 The distorted view of Penrose Impossible Triangle

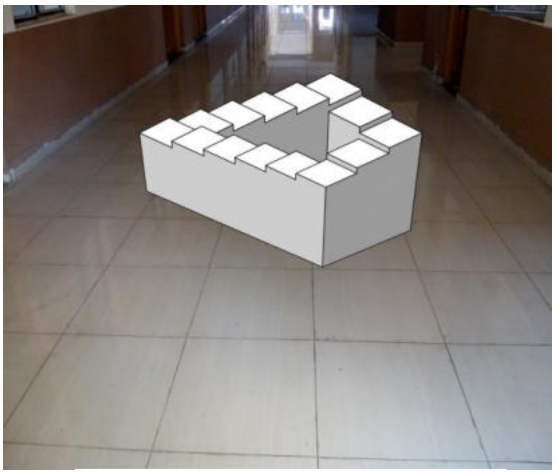

Fig.14 The Penrose Stairs on a plane surface

There is an example of 3D realization of Penrose impossible Triangle this was done by Gregory. The Penrose Impossible triangle is an imaginary 3D structure which we can imagine that but it can't be constructed physically. The Fig.15 shows 3D model of Penrose Impossible Triangle.

Bruno Ernst and Richard Gregory created a 3D model of Penrose Impossible Triangle, when it is seen from a specific viewpoint, It looks real, totally consistent. Here is an example made by Bruno Ernst with its reflection in a mirror. The real 3D models of impossible objects are viewable geometrically possible, visible only from a specific viewpoint. Bruno Ernst and Richard Gregory created a 3D model which is an anamorphosis. This 3D model has three rods that appear to close into the Penrose Impossible Triangle when it is observed from a specific view point but it looks abnormal construction when it is observed from a general view point, here traditional anamorphosis gives a meaningful appearance when it is seen from a specific view point but the topology disturbing objects can be sensed from two different specific view points, from which they look meaningful. From this aspect of their nature, it might be considered that the topology disturbing object as a kind of multiple anamorphosis.

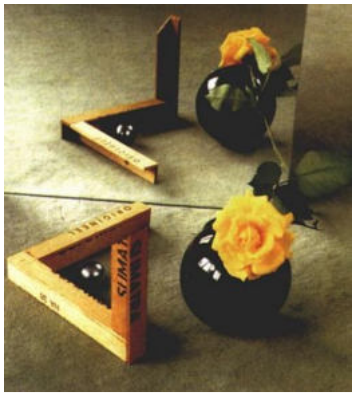

Fig.15 3D model of Penrose Impossible Triangle

Conclusion

A brief concept and few types of topology disturbing designs are discussed this paper. Anamorphic drawings have only one specific view point to perceive it as a 3 Dimensional design. Impossible objects also can be seen as meaningful objects from only one specific viewpoint. Ambiguous objects can be realized from two or more different viewpoints. The visual effect of topology change can be considered as one of the variants of traditional anamorphosis. The appropriate combination of these techniques will give different illusion effects.

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