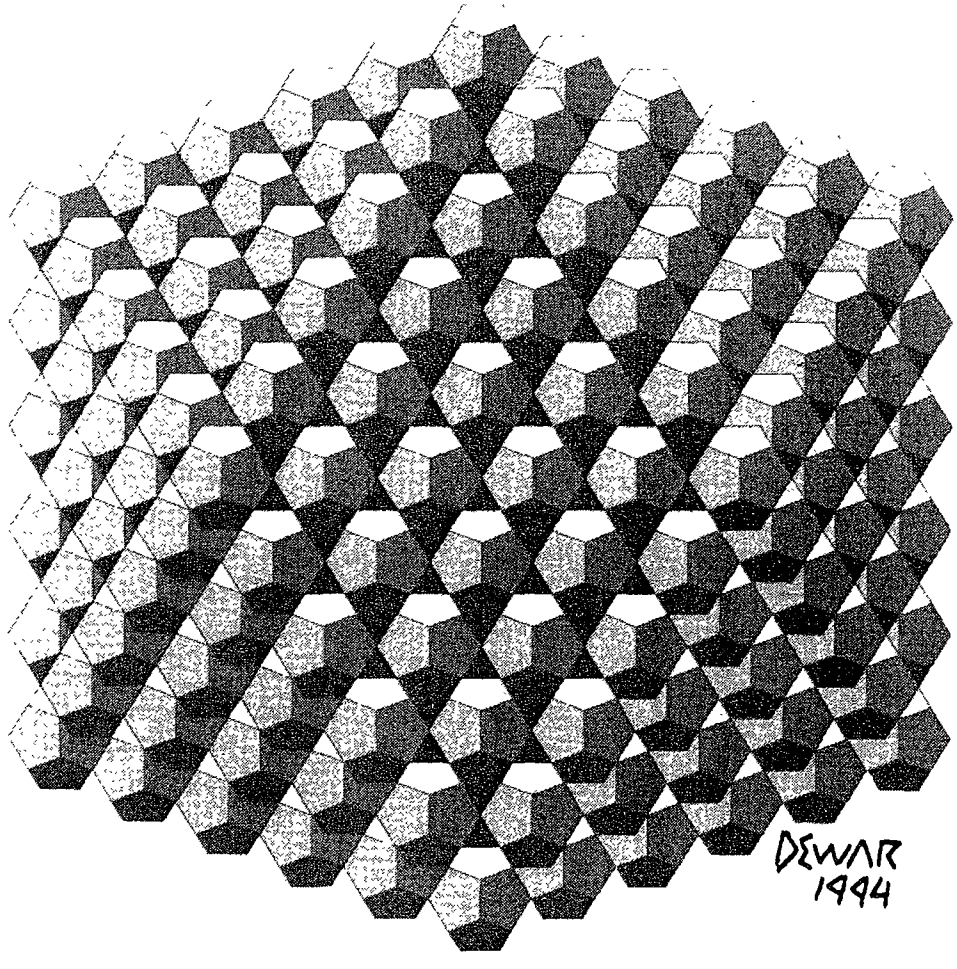
Symmetry: Culture and Science

Symmetry:
Natural and Artificial, 1

The Quarterly of the
International Society for the
Interdisciplinary Study of Symmetry
(ISIS-Symmetry)

Editors:
György Darvas and Dénes Nagy

Volume 6, Number 1, 1995



Third Interdisciplinary Symmetry Congress and Exhibition
Washington, D.C., U.S.A. August 14 - 20, 1995

CONSTRUCTION OF A NON-ORIENTABLE MOBIUS OBJECT

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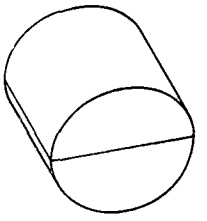
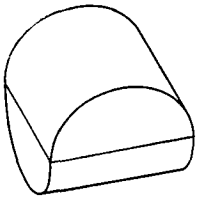
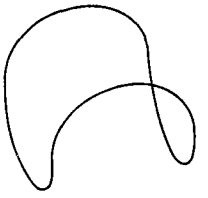
This project began as the final exercise in a Graduate Design Studio taken with Professor William S. Huff in the Spring of 1994. The project involved the design and construction of a non-orientable mobius object. I began by looking at a model for a robotic arm that I made for another class the previous year. One of the essential pieces of the robotic arm is unique in that it allows for rotational movement around two perpendicular axes. The resultant form is an object with two faces and only one edge. The object can be viewed as a cylinder of equal diameter and height being cut in half across the diameter and then rotated 90 degrees on the cut. I will call the object a half rotated cylinder. I imagined that somehow the single edge of this object could be transformed into a non-orientable, mobius surface. Intuition along with empirical study led me to believe that this was indeed true and quite possible.

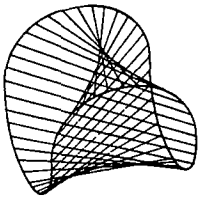
Investigation began with a three dimensional model of the edge of the half rotated cylinder. This consisted of a single wire bent into four interconnecting semicircles. Upon constructing the edge, I realized that a line could connect the edges by incrementally sliding and rotating up and down the "Z" axis. The length of the line is centered upon the "Z" axis and expands and contracts in the "X" and "Y" dimensions to form one curvilinear interconnected plane. I then discovered that if I disregarded a spatial overlap where the plane collided upon itself on the "Z" axis, a single surface had been achieved.

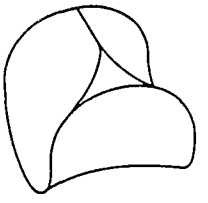
Figure 1. Diagram showing cylinder, cut cylinder half rotated, wire model of the continuous edge, expanding and contracting straight lines of edge connection, and final planar model.











A task arose in making the final planar model of the object. Until this point in the project I was working with wire frame models and I needed to discover a way to construct the model out of a thin sheet of planar material. The solution arose through an analysis of the single plane that folded in upon itself. The single plane was split into two identical halves placed mutually perpendicular to each other. One hole was added to each half to allow for a true mobius structure with one continuous surface. Without the holes the plane collides upon itself on the "Z" axis.

Construction of the mobius model:

1 Cut out two identically dimensioned squares of thin flexible material.

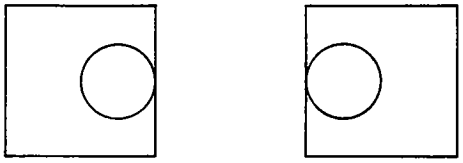
2 Draw a circle on each square plane. The circle should be located on the central axis of the square tangential to one edge with the diameter equal to half the length of one side of the square.

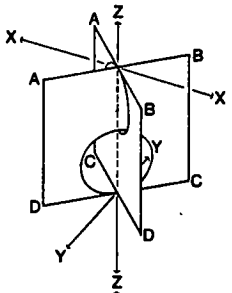
3 Interlock the two planes together in a mutually perpendicular manner so that the circular void in one plane accepts the positive material of the other.

4 Fold the corners marked "A" together to form a smooth curve centered upon the "X" axis and fasten the edges together with tape or adhesive. Perform the same operation for the corners marked "B" upon the "X" axis, "C" upon the "Y" axis, and "D" upon the "Y" axis. The resultant form will be a single plane with one continuous surface. The inherent symmetry of the form is that of fourfold mirror-rotation symmetry around the "Z" axis.

5 To break down the Non-Orientable Mobius Object into a linear strip cut along the "Z" axis. The resultant form will be a ring resembling a crown. Cut the ring and the original square planes will now be one planar strip half the dimension of the square in width and four times the dimension of the square in length.

Figure 2. Diagram showing two planes with holes, perpendicular arrangement of the planes, folded model, model cut into crown form along "Z" axis, and final strip of material. This representation demonstrates the construction of the Non-Orientable Mobius Object.

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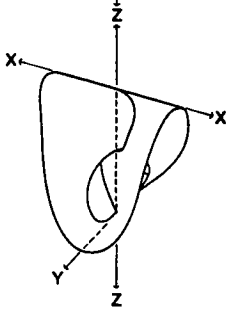
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