Symmetric Folded D-Forms from a Cylinder and Two Cones

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Inspired by a sculpture of the artist Susan Latham, we show the mathematical existence of the folded Vesica Piscis. This is a closed shape obtained by folding the union of two discs, so that the boundaries can be glued together, see Fig. 1. The resulting symmetric object consists of a cylinder connected with two cones through curved creases. Shapes that result from gluing two convex planar regions of equal perimeter are called D-forms and were introduced by Wills in [1], and generalized to seam-forms in [2] by allowing combinations of multiple planar convex regions. Pemitting also folding, the folded Vesica Piscis may be considered an example of a further generalization of these shapes.

Moreover, the ideas derived during the study of this object can be applied to compute other closed nonplanar shapes obtained by gluing the boundary of symmetric domains, so that they consist of a cylindrical and two conical parts, cf. Fig. 2.



Figure 1: Folded Vesica Piscis (left) and its development (right)



Figure 2: A folded D-form (left) and its symmetric development (right)

Joint work with: Tony Wills.

References

- T. Wills. D-Forms: 3D Forms from 2D sheets. Bridges: Mathematical Connections in Art, Music, and Science, London, pp. 503–510, 2006.
- [2] E. Demaine and G. Price. Generalized D-Forms Have No Spurious Creases. Discrete & Computational Geometry, vol 43(1), pp. 179–186, 2009.